FACULTY OF SCIENCE
UNIVERSITY OF COPENHAGEN

Master Thesis

Eva M. Elise Kraus

The Impact of Sustainable Certifications on Coffee Farming Practices

A Case Study from Tarrazú Region, Costa Rica

Supervisors at the University of Copenhagen: Aske Skovmand Bosselmann and Andreas de Neergaard
Institute for Food and Resource Economics and Dept. of Plant and Environmental Science
External supervisor: Nicole Sibelet, CIRAD/CATIE
Submitted: 15. July 2015
In partial fulfilment of a M.Sc.in Agricutural Development

Abstract

During the past decades, sustainable coffee certifications have become increasingly popular amongst the global consumer audience. These seals often evoke the impression that by buying certified coffee, environmental and socio-economic conditions in coffee production are improved. Many of the certifications rely on producer cooperatives to reach the individual farmer. However, studies investigating how theoretical certification standards are put into practice at farm-and cooperative level are scarce. This is especially the case for environmental standards. In consequence, it is not clear what constraints farmers and cooperative managers face in “greening” practices as aimed for by certifications.

This case study portrays how environmental certification guidelines are implemented in two adjacent coffee cooperatives in Tarrazú region, Costa Rica. The objective was to investigate the impact of certifications on farming practices and to identify the main farm-and cooperative-level constrains for a more sustainable coffee production. The certifications researched were Fairtrade and C.A.F.E. Practices, which are managed as *group certifications* by the cooperatives (all farmers are certified collectively) as well as Rainforest Alliance, which is managed as *individual certification* (only some of the farmers at one of the cooperatives are certified). A mixed-methods approach was used, combining both quantitative and qualitative data. Data were mainly derived from a questionnaire survey with farmers (n=47), discussions with cooperative administrators (n=5), and key person interviews (n=2). Review of internal documents as well as review of secondary data complemented the findings.

The study found that farmers being only certified Fairtrade and C.A.F.E. Practices are largely not aware of their participation in the programs. Thus, changes in farming practices due to group certifications could only to a very limited extent be identified. In the case of Rainforest Alliance, the main changes due to certifications as pointed out by certified farmers were an increased use of vegetation barriers as well as the banning of certain types of agro-chemicals. For the sample as a whole, since the introduction of certifications it could be observed a “greening” of farming practices. This applies to the use of herbicides as well as shade providing species in coffee fields, and to a limited extent regarding the use of compost/coffee pulp as soil amendments. Drawing from the questionnaire survey and various discussions with cooperative administrators, group certifications were found to have an impact on farming practices. They indirectly influence farming practices through the cooperatives. The effect of certifications on farming practices is relativized by the fact that the integration of certification standards into the cooperatives’ services happened in an environment of an already ongoing discourse.

The study identified as major constraints for a sustainable coffee production as fostered by certifications on the farm-level: the occurrence of a new pest, a new generation of farmers using more inputs as well as the farmers’ perceptions of organic fertilizers/soil amendments as being inefficient and impractical. On the cooperative level, the major constraints were the two-fold strategies of the cooperatives which have to balance productivity and environmental sustainability goals, as well as a lack of capacities to disseminate information. Findings suggest that strengthening of the cooperatives’ capacities and/or technical assistance are key to mediating a “greening” impact of certifications on farming practices.

Preface and Acknowledgements

This Work is based on nearly 3 months of fieldwork with two coffee cooperatives in the mountains of Tarrazú region, Costa Rica. The thesis is embedded into a larger study about the Impacts of Coffee Certifications in Costa Rican coffee cooperatives by Anna Snider (PhD Candidate, AgTrain Program, Montpellier/Madrid). While this contribution investigates environmental aspects of coffee certifications, the larger project also explores social and economic impacts of certifications [1].

Fieldwork, preparations for fieldwork and the writing of the thesis have been accompanied by my main supervisors at Copenhagen University, Aske Skovmand Bosselmann and Andreas de Neergaard. The main contact was Aske, who has himself studied land use changes among coffee farmers in Costa Rica and is thus knowledgeable about the study context. Andreas de Neergaard supported me mainly in networking and organizational tasks.

During fieldwork in Costa Rica, I collaborated closely with Anna Snider. Her supervisor, Nicole Sibelet, a rural sociologist (CATIE/CIRAD), has also accompanied my fieldwork as external supervisor. The local partner institution in Costa Rica was CATIE (Tropical Agricultural Research and Higher Education Centre).

A diverse team of advisors from different backgrounds has supported the process from planning, to conducting up to writing the thesis. I would like to thank Aske Skovmand Bosselmann, for his valuable inputs which have helped me to "stay in focus" and structure my thoughts. I would also like to thank Andreas de Neergaard, for supporting me in regard to building up a network and helping me handle the formalities. Special thanks goes to Anna Snider, which has been a great support and inspiration in all matters before, during and after fieldwork. Without her this thesis would not have been possible. Sharing experiences made the whole process a lot more pleasant.

The contributions from Nicole Sibelet helped me gaining an anthropological approach to research which was very different from what I've learned at university. I also appreciated very much her personal uncomplicated nature, which created a fruitful atmosphere for learning and exchange.

I would also like to thank my family and friends for supporting me in every way. Above all, the generous Franz Xaver deserves a triple thanks for motivating, empathizing and supporting me throughout the writing process. Last but not least, and most importantly, I am grateful for the Village of Llano Bonito and its inhabitants to have welcomed me and hosted me throughout my entire stay. Especially Olga and Juan-José have made me feel "at home away from home"

[1] The overall investigation is in line with the three pillars of sustainability: social, economic and environmental sustainability. To make the document easier to read, whenever sustainability is referred to in this document, it is referred *specifically* to environmental sustainability.

Content

List of Figures

List of Tables

List of Graphs

1. Introduction

In this chapter I will introduce the real world problem that constituted the motivation to conduct this study (Section 1.1). I will then briefly point out in what way my study may contribute to addressing that problem (Section 1.2) before moving on to the Study Objective and the Research Questions that guided the analysis (Section 1.3). Section 1.4 provides a guidance of how the document is structured and should provide an overview of what to expect.

1.1. Motivation for the Study

The global market for coffee is currently undergoing some major structural changes (Valkila & Nygren, 2010) with unknown consequences for conditions in coffee production. The global demand for certified coffee which has been produced under environmentally and socially favorable conditions has strongly increased during recent years (Blackman & Rivera, 2010; ITC, 2011b; Raynolds, 2009), due to rising consumer awareness. At the same time, it is hoped that higher prices paid for certified coffee can compensate for low and volatile prices in the conventional market (Rice, 2003; Wollni, 2007).

Also in Costa Rica, which is amongst the Top 15 coffee producing countries worldwide (ICO, 2015), coffee producers have reacted to current market trends. 40% of all the coffee produced in the country comes from member-owned cooperatives (ICAFE, 2013) where coffee is produced mainly on a small or family scale (Castro, 2013). Meanwhile, most of the cooperatives in the country hold one or more certifications. The most common labels used by Costa Rican cooperatives are Fairtrade, C.A.F.E. Practices and Rainforest Alliance, all of which contain to some degree social as well as environmental requirements for production (Fairtrade Itl., 2011a; SAN, 2010; Starbucks Coffee Company, 2014). According to a Research Paper published by the World Bank “There are obvious advantages for Costa Rica to pursue [….] certifications”(Varangis et al., 2003).

Certifications are thought to have the *potential* to improve environmental conditions in production (Hatanaka et al., 2005). Yet it has been generally challenged whether certifications are actually able to achieve what they aim for (Sick 2008; Utting-Chamorro, 2005). Indeed, studies about the environmental impact of certification show mixed results (Blackman & Rivera, 2010). After carefully reviewing the existing literature, it has thus been concluded that certifications are “too complex and heterogeneous to be described as effective or not effective in a binary way” (Paschall, 2013).

The overall impacts of certifications are heavily influenced by local conditions (Giovannucci et al., 2008; ITC, 2011a). Even though some case studies have taken into account local contexts in their analyses, they have widely ignored the practical implementation of environmental standards at the cooperative and farm level. Instead research has almost exclusively focused on evaluating the environmental outcomes of the system rather than the pathway through which certifications work. In consequence, it has been suggested that current studies in the field mainly deal with ‘proving’ rather than ‘improving’ the efficiency of certifications (ITC, 2011a).

However, I argue that the investigation of *how* certification standards are put into practice at the cooperative and farm level is crucial for identifying possible farm- and cooperative constraints to a more sustainable coffee production. Only if these constraints are addressed, certifications will be able to deliver what they promise (Utting-Chamorro, 2005).

1.2. Contribution of this Study

This study will inform how environmental certification standards are translated into practice in two coffee cooperatives in Tarrazú region, Costa Rica. It will not only explore the *outcome* of certifications by looking at how farming practices have changed, but also investigate the role of the cooperatives in mediating this *process*. Based on this, I will be able to identify and discuss farm- and cooperative-level constraints to a sustainable coffee production as fostered by certifications.

The contribution of this study is four-fold: First, the data generated in this study may serve as a baseline for future investigations in the area. The cooperatives will receive the raw data as well as a copy of the thesis, as agreed upon with the cooperatives' managers. Second, actors in the coffee value chain and certification organizations might use this case report for better understanding of the local impacts of their initiatives. In the discussion of the effects of certification, it was mentioned that certification programs struggle to account for the great diversity of social contexts in which coffee is grown (Auld, 2010). Especially the specific local constraints I identify, that impede a more sustainable coffee production, might serve as inspiration for possible improvements in the system and adaptation of standards to local conditions. Third, it is for consumers to be informed about the impact of their product choice. A growing consumer segment is critical towards green branding and has started to seek information (Ottman, 2011). Thus arises the necessity to make certification systems transparent and accountable (Raynolds et. al, 2007).

1.3. Objective, Research Questions and Hypotheses

Objective

To investigate farm- and cooperative-level impacts of coffee certifications on farming practices

and

To characterize farm-and cooperative-level constraints for a sustainable coffee production as aimed for by certifications

Research Questions and Hypotheses

1) How have farmers experienced certifications to impact their farming practices?
   Hypothesis: Most farmers have experienced a "greening" of farming practices due to environmental certification standards. Different certifications have affected farming practices in different ways.

2) How have certifications affected the services the cooperative offers to farmers?
   Hypothesis: Because of certifications, the cooperatives have started to integrate sustainability topics into the services offered to members.

3) To what extent can any "greening" of farming practices be attributed to certification impacts mediated by the cooperatives?
   Hypothesis: The cooperatives are important sources of information for farmers, e.g. by providing extension services. In consequence, cooperatives are important mediators of environmental standards as described by certifications thus 'greening' farming practices.

4) What are the farm- and cooperative level constraints for a sustainable coffee production as fostered by certifications?
   Hypothesis: Certifications foster sustainable production by encouraging to keep the use of agrochemicals at a minimum and by promoting organic practices. However, cooperatives and farmers generally aim for an optimal production and are involved in agri-industrial networks, including input companies. Thus, the cooperatives' services as well as farmers' strategies might oppose environmental sustainability goals. Besides, the cooperatives' capacities to disseminate information on sustainable farming practices is restrained. Producers, in their actual situation, do not perceive sustainable practices as desirable. Certain producer characteristics impede the environmental sustainability in farming practices.

By “greening” of farming practices I refer to either a reduction of chemical inputs (Group 1) or an increase in organic practices (Group 2).

The Farming Practices investigated in this study are limited to the following:

Group 1

- Use of herbicides (Application Rate)[2]
- Use of fungicides (Application Rate)
- Use of chemical fertilizers(Application Rate)

Group 2

- Use of methods of Integrated Pest Management (Use or not? Which kind?)
- Use of Soil amendments/organic fertilizers (Use or not? Which kind?)
- Use of Shade Providing Species (Increase?, species diversity)
- Use of vegetation barriers

Note: All of the above mentioned farming practices are integral part of the different certifications investigated in this study. The standards encourage a decrease in group 1 and an increase in group 2 practices.

1.4. Structure of this Document

The document is divided into different Chapters. In Chapter 2 (Background) I start out describing the context of coffee certifications in Costa Rica, from which this study draws. Chapter 3 (Theoretical Framework) describes the thought concept underlying this research, based on theory found in the literature. Chapter 4 then deals with Methodology and includes a subsection describing the study site. Chapter 5 presents the main findings of this research. In Chapter 6 (Discussion) I critically examine the findings from relevant literature. In Chapter 7 (Conclusion) I summarize what we have learned from this study. The last chapter (Practical Implications) provides some prospects of what is important to be addressed by future research and relevant actors.

[2] I considered application rates as an indicator for changes in agrochemicals use, since during preparations of fieldwork at the study site it became clear that farmers mostly claimed to have *not* made changes regarding the dosage of agrochemicals, but rather only changes regarding the application rate. Yet, one has to keep in mind that total agrochemical use is a function of dosage and application rate.

2. Background

The purpose of this Chapter is to familiarize the reader with the broader context of the study. Section 2.1 explains how coffee certifications emerged in the face of a global coffee crisis. Section 2.2 describes briefly what role "sustainable" coffee certifications play in Costa Rica today. Section 2.3 then informs about past and actual conditions in Costa Rican coffee production, before the different types of certifications relevant for this study are introduced in Section 2.4.

2.1. The Coffee Crisis and the Emergence of Coffee Certifications

The collapse of the International Coffee Agreement[3] in 1989 was the beginning of a global crisis in coffee prices (Bates, 1998) which also affected Costa Rican coffee farmers. In the years after the collapse, prices fell (1989-1993) sharply. In fact the average real indicator price during the 4 years after 1989 was around 60% lower than the average price the 4 years before (Ponte, 2002). Lower prices resulted in lower incomes for coffee producers (Lewin et al., 2004). Even though Costa Rican growers have gotten used to volatile coffee prices during many generations (Luetchford, 2007), the situation was more serious than ever before. Some of the Costa Rican coffee farmers had to give up their farms because coffee farming was not lucrative anymore (Samper, 2010).

In 1994, coffee prices rose again because of huge harvest losses in Brazil due to a frost and in Colombia due to a pest outbreak. Yet after this short recovery started a long period of decreasing coffee prices. The increasing trade liberalization coinciding with the ICA collapse (Bacon, 2005) in conjunction with an increasing supply from Brazil as well as Vietnam entering coffee production has contributed to what has been named "the coffee crisis" (Muradian & Pelupessy, 2005). But the crisis was limited to producer countries. While during this period the imbalances between supply and demand have negatively affected the incomes of producers, the development of the coffee economy in importing countries has in fact been positive (Osorio, 2005).

The crisis is relevant for this study because the de-regulation of coffee prices after the collapse of the ICA, together with a market-liberalizing policy at that time have led to some structural changes in the Costa Rican coffee sector. The absence of intergovernmental regulations is associated with the proliferation of voluntary standards in order to make up for the missing governmental regulation of social and environmental conditions in global value chains (Bernstein & Cashore, 2007) (Raynolds et al., 2007). Indeed on a global scale, the coffee crisis coincided with the emergence of third party coffee certifications (Muradian & Pelupessy, 2005). This had an influence also on Costa Rican coffee farmers. In Costa Rica after 1989 began a process in which many individual farmers and cooperatives started to enter the market for specialty coffees[4]. It was hoped that this would make Costa Rican coffee producers less vulnerable to volatile and low prices. The next section will describe the importance of sustainable certifications for the strategies pursued by Costa Rican coffee cooperatives.

[3] Between 1962 and 1989 world coffee trade was regulated by the International Coffee Agreement (ICA). The agreement was made between coffee producing and consuming countries and has widely been considered successful in stabilizing world market prices for coffee. The price stabilization was achieved by limiting the quantity of each producing country's coffee exports to the actual demand for coffee. (Bates, 1998); (Akiyama & Varangis, 1990)

[4] Specialty coffees also include "sustainable" coffee certifications such as Fair Trade and certified organic (Bacon, 2005)

2.2. "Sustainable" Certifications in Costa Rican Coffee Cooperatives

In Costa Rica, the majority of small-scale farmers are organized in producer cooperatives (Castro, 2013). Most of the cooperatives have established their own coffee mills (*beneficios*), where the coffee produced by the individual members is collectively processed. Today, farmer cooperatives which are owned by their members process about 40% of the national coffee production (ICAFE, 2013).

One commonly cited advantage of Cooperatives is that they ease market access for farmers (Chen et al., 2006; World Bank 2003), including the market for specialty coffee, to which certified coffee belongs. A case study from Costa Rica showed that the likelihood for farmers to participate in the specialty market for coffee is significantly higher for members of a cooperatives than for farmers not being members of a cooperative (Wollni, 2007).

The importance of the cooperative in mediating the benefits of certifications was also acknowledged by another study about specialty coffee in Nicaragua. It emphasizes that for Fairtrade, farmers only have access to benefits from market *because* of the cooperative. This has significant impacts on farmers' incomes as the author concludes that "The cooperative is the primary intervening variable affecting prices received at the farm gate" (Bacon, 2005).

In Costa Rica today, certifications have become quasi mandatory amongst coffee cooperatives. In fact, data from 2013 [5] show that of the 22 Costa Rican coffee cooperatives, only 4 did not participate in any certification program at the time fieldwork was conducted. It was furthermore not uncommon for a cooperative to have more than one certification. Amongst the 18 certified ones, 55% (10/18) had more than one certification.

The same field trip also revealed that Fairtrade is the most commonly held certification with 78% (14/18) of all certified cooperatives participating. This was followed by Starbucks' C.A.F.E. Practices which was held by 44% (8/18) and Rainforest Alliance held by 28 % (5/18) of cooperatives that participated in certifications[6].

No matter the type of label, producers need to fulfill specific requirements or standards. Most of the certifications put a strong emphasis on environmentally sound production practices and social equity (Raynolds et al., 2007). This also applies to the three most common labels amongst Costa Rican coffee cooperatives.

For individual farmers to be able to adapt to these standards, information about certifications provided by the cooperatives might be crucial. The role of coffee cooperatives in helping farmers to meet certification requirements was also acknowledged by the World Bank. As a strategy to mitigate the coffee crisis in Central America it was suggested to support cooperatives in their role to"[…] disseminate quality standards and best practices in coffee farm care [..]." so that small producers can become part of the uprising market for specialty coffees (Varangis et al., 2003).

Yet evidence of the role that Costa Rican cooperatives play in disseminating information about farm management practices is almost absent. Babin (2014) however explains how in Costa Rica, a cooperative management *indirectly* affected farming practices by establishing links to other extension institutions which were promoting "green" farming practices. Furthermore, a study from neighboring Nicaragua compared practices related to the use of shade trees between different

[5] Fieldwork conducted by Anna Snider, as part of her PhD on coffee certifications in Costa Rica.
[6] Findings were deducted from data [publication in progress] by Anna Snider. (Snider, 2013)

cooperatives. They argue that the type of cooperative management is key to the type of practices employed by farmers (Méndez et al., 2009).

Despite scarce evidence, I expect that cooperatives are important in mediating environmental requirements of coffee certifications to their members. In Costa Rica, besides providing market access and processing the coffee, cooperatives traditionally offer services to their members, comprising credit schemes but also technical assistance with coffee farming matters. By integrating certification standards into their strategies, cooperatives might thus be key to a change in environmental conditions in Costa Rican Coffee production.

2.3. Environmental Conditions in Costa Rican Coffee Production

In many parts of Central America, ecosystems in which coffee is grown have been transformed from traditionally diverse agroforestry systems to plantations with little or no shade tree coverage (Beer et. al, 1997; Rice & Ward, 1996). The intensification of farming systems is especially attractive to farmers when coffee prices are high because maximum productivity can be reached in systems with coffee growing in high sun exposure (Willey, 1975).

In Costa Rica, the agro-ecological transformation of coffee farms went hand in hand with the introduction of higher-yielding varieties from Brazil. *Caturra* (introduced in 1952) and *Catuai* (introduced in 1965) are still today the most used varieties in the study area[7]. These are, unlike older varieties, tolerant to high sun exposure. For optimal productivity, it was recommended for the new varieties to lower the planting densities in coffee plantations (Castro, 2013). In Costa Rica, the consequence was a process which was elsewhere described a “dramatic technological change” (Jha et al., 2011) accompanied by the near elimination of shade tree canopy and an increased use of agrochemicals (Castro-Tanzi et al., 2012). From the mid-70s onwards agricultural intensification proceeded fast so that in the mid-80s Costa Rica had become the country with the highest average yield/ha in the world (Babin, 2014; Castro, 2013; Samper, 2010).

While the high-input system has been promoted by the cooperatives and the government at the time the “green revolution” was at its peak in Costa Rica, soon people started to consider the downsides of this development. Intensified coffee production in Central America has been linked to environmental pollution and decreasing soil quality (Fernández & Muschler, 1999; Rice, 1991). Furthermore, in Costa Rica, the excessive use of fertilizers has raised concerns about the extent of nitrogen leaching from sun-grown coffee plantations (Babbar & Zak, 1995).

Because of the potential adverse effects it has on the environment, coffee production in Costa Rica started to evoke critics already during the 90s (Lyngbaek & Muschler, 2001). The environmental discourse in the South soon reached the global consumer in the North who started to become aware of the conditions under which coffee was produced. Combined with social concerns related to the coffee crisis, this gave way to the rise to sustainable certifications.

[7] According to Data from survey

2.4. Fairtrade, Rainforest Alliance, C.A.F.E. Practices: Similarities and Differences

2.4.1. Fairtrade

In 1988, the first Fair Trade label[8] was launched by a Dutch NGO that had teamed up with a Mexican coffee cooperative. The aim was to improve the socioeconomic situation of producers. Since then, a variety of fair trade labelling initiatives came up which are today pooled together at FLO[9] using one common Fairtrade mark (Bacon, 2005). Fairtrade aims at supporting the producer in the South through the sales of coffee (Raynolds et al., 2007) and, in contrast to the other two certifications, Fairtrade has the declared goal to correct for market distortions (Oram & Winnet, 2002). Fairtrade is the only one of the three seals that guarantees a minimum price paid to producers. Thus, Fairtrade certifies the *trade process* in addition to the *production process* (Bacon, 2005) certified by the other two. It also obliges the cooperative to invest some of the profits derived from the Fairtrade sales into communal projects, such as infrastructure, education etc. Fairtrade chose to only certify "small-scale producers" which are organized into farmers' organizations (Renard, 2003).

2.4.2. Rainforest Alliance and SAN (=Sustainable Agricultural Network)

The Rainforest Alliance seal for coffee has existed since 1996 (Raynolds et al., 2007) and the seal itself was originating from an environmental movement. Despite its former focus exclusively on environmental standards the Alliance has meanwhile also integrated social standards into the list of criteria for certified producers. The standards themselves were developed by SAN, a group of environmental NGOs (Rueda & Lambin, 2013; SAN, 2010) . Today the Rainforest Alliance envisions "a world where people can thrive and prosper in harmony with the land" (Rainforest Alliance, 2015). In contrast to Fair Trade, it is part of the Alliance's strategy to certify also, but not only, big landholdings.

2.4.3. C.A.F.E. Practices (=Coffee and Farmer Equity)

Of the three certifications, C.A.F.E. Practices is the only first party certification, meaning that it was introduced by a company (Starbucks) as an internal sourcing system. Starbucks scores producers according to the proportion of standards they meet and then classify them into "strategic", "preferred" or "verified" producers. The strategic producers are highest preferred. Founded only in 2004, C.A.F.E. Practices expanded rapidly so that already in 2013, more than 95% of the coffee purchased by Starbucks was "ethically sourced" (Starbucks, 2013).

2.4.4. Comparison of Standards

All in all, there are many parallels found concerning the content of environmental criteria. All three certifications encourage farmers to use less agrochemicals with the purpose to keep impacts of coffee production on the environment at a minimum. They furthermore all contain standards about the use of organic practices to control pests on top of chemical methods, whenever possible, which is part of the "Integrated Pest Management (IPM)" concept. Furthermore, all three deal with the employment of organic fertilizers/soil amendments in farming. Yet, there are some differences in how standards are formulated, especially with regard to the responsibility the cooperative management has in comparison to the individual farmer (see Table 1, next page)

[8] Fair Trade describes a concept whereas Fairtrade describes a mark. In this study, I distinguish between the Fair Trade concept and the Fairtrade mark by the spelling (Fair Trade vs. Fairtrade).

[9] FLO= Fairtrade Labelling Organizations International. FLO was founded in 1997 to "unite the national Fairtrade organizations under one umbrella and harmonize worldwide standards and certification". The common Fairtrade mark was launched in 2002 (Fairtrade Itl. 2011b)

Table 1: Comparison of standards (own synopsis)

	RAINFOREST ALLIANCE	FAIRTRADE	C.A.F.E. PRACTICES
VERSION REVISED	SAN V.3 (2010)	V 1.2 (2011)	V 3.3 (2014)
COMPLIANCE WITH STANDARDS DEMANDED	Must comply with 100% of core criteria[10], 80% compliance with other criteria.	Must comply with 100% of core criteria. % of compliance with other criteria is based on Progress (% depends on no. of years after first certification)	Must comply with 100% of core criteria, % of compliance with other criteria determines Starbucks' rank in its list of "preferred suppliers"
CONSEQUENCES FOR NON-COMPLIANCE	Permission to Sell coffee "Rainforest Alliance" withdrawn if not corrected for.	Suspension for a certain, undefined time period. Permission to Sell coffee as "Fairtrade" withdrawn if not corrected for.	Rated less preferred supplier. Rejection of coffee in case of non-conformity with core criteria *possible*.
DEMANDS FROM COOPERATIVE-LEVEL	High demands, but mainly based on control and monitoring activities of individual farmers. Demands trainings for members to comply with SAN standards.	High demands, mainly based on training activities and documentation of these activities. Cooperative in the position to encourage farmers to change farming practices.	Low
DEMANDS FOR FARM-LEVEL REQUIREMENTS	High demands, very specific. Demands members to document their management activities.	Low demands, no specific requirements	High, very specific.
TYPICAL EXAMPLE OF STANDARD	The farm must demonstrate by comparative agrochemical inventories and use records that it rotates chemical products and reduces their use for crop production.	Cooperative must encourage farmers to use less herbicides. Cooperative must provide training about responsible use of fertilizers.	*Each of the following standards, if met, contribute to a higher overall "score" in Starbucks preferred supplier list:* Farmers do not use herbicides. Farmers limit herbicide use to certain areas. Pesticides are only applied as a last resort. Pesticides are applied only on a spot-basis.

Note: Synopsis is based on official certification guidelines (Fairtrade Itl., 2011a; SAN, 2010; Starbucks Coffee Company, 2014)

[10] Core Criteria= Criteria rated very important by the certification agencies so that cooperative/producers **must** comply with these. Core criteria include e.g. the banning of prohibited pesticides and the enforcement of national labour laws, e.g. minimum salary and child labour.

3. Theoretical Framework

In this chapter I present the analytical concepts underlying this study. I will start out by providing a short description about what Impact Evaluations are, since I consider this study to be one (Section 3.1). Then I give an overview of different approaches found in the literature that have been used to study the environmental impacts of certifications. (Section 3.2). This is followed by a constructive critique of previous approaches, in which I will point out some of the limitations (Section 3.3). I will close this chapter by presenting the logic model which I have based this study on (Section 3.4).

3.1. What are Impact Evaluations?

There seems to be a general confusion about the concepts and definitions underlying impact evaluations. I will now clarify the concepts and definitions used in this study.

According to the OECD "Impact evaluation is an assessment of how the intervention being evaluated affects outcomes" (OECD, 2006). While this is unambiguously what I want to do, considering certification an intervention, impact evaluations are commonly linked with rigorous quantitative study designs. "The proper analysis of impact requires a counterfactual of what those outcomes would have been in the absence of the intervention" (OECD, 2006) or "Impact evaluations have either an experimental or quasi-experimental design" (i3, 2012) are some of the statements found in the literature.

Yet the World Bank commonly uses case studies for Impact Evaluations and published a guidebook specifically for this purpose as they expressed that "Case studies are appropriate for determining the effects of programs or projects and reasons for success or failure" (Morra & Friedlander, 1999). A similar line of thought stems from medical research (Balbach, 1999). We thus consider this study an impact evaluation, even though it might not fit the "classical definition".

3.2. Existing Approaches

There have been only few studies investigating the environmental impact of coffee certification standards, since most studies focus on social or economic rather than environmental effects (Barham & Weber, 2012; Elder et al., 2013; ITC, 2011a). Amongst the existing studies that have focused on environmental impacts of certifications I can distinguish between different groups, depending on the type of outcome that was measured. An outcome may be defined as "A variable, or variables, which measure the impact of the intervention" (i3, 2012). Accordingly, researchers have chosen different variables.

Most studies have either looked at how certifications have altered environmental outcomes (water quality, soil quality, shade trees) or how they have influenced farming practices. The latter one has been suggested easier to prove, as farming practices might be more easily changed by certifications than environmental outcomes (Blackman & Naranjo, 2012). This might be one of the reasons why most studies have chosen farming practices as an indicator for environmental impact. Table 2 below provides an overview of studies that investigated the impact of environmental standards, including the major findings [11].

[11] I do not include studies that *exclusively* investigate the impact of organic certification. This is because organic certification has stricter requirements concerning farming practices than the certifications dealt with in this study have, the latter ones rather encouraging than demanding sustainable practices

Table 2: Studies investigating the Impact of environmental coffee certification standards on either farming practices and/or environmental conditions

AUTHOR YEAR	CERTIFICATION(S)	COUNTRY	OUTCOMES INVESTGATED	FINDINGS
QUISPE GUANCA, 2007	Fairtrade, Rainforest Alliance, organic	Costa Rica	Farming Practices	General effect on farming practices small. Major effect: reduction of herbicides. Rainforest Alliance has led to increase in shade trees, small decrease in chemical fertilizer/increase of organic fertilizers. Rainforest Alliance has led to increase in number of soil conservation practices.
VALKILA, 2009	Fairtrade, Fairtrade+organic	Nicaragua	Farming Practices	Cooperative helped transition to organic with help of NGOs. If Fairtrade only farmers use less agrochemicals, it's because of costs not conviction.
BACON ET AL, 2008)	Fairtrade	Nicaragua	Farming Practices	43% of Fairtrade farmers implemented soil and water conservation practices, compared to 10% of t non-certified farmers. 68% of Fair Trade farmers, and 40% of non-certified farmers, had implemented water purification system
ARNOULD, PLASTINA & BAIL, 2006	Fairtrade	Nicaragua and Guatemala	Farming Practices	Nicaragua: Fairtrade members have increased shade. Guatemala: Fairtrade farmers use more organic fertilizer/soil amendments.
GALINDO, ET AL., 2014	Rainforest Alliance	Colombia	Environmental conditions	Better water quality (different biophysical indicators), more vegetation cover in Rainforest Alliance certified farms
CONSTANTINO, UNKNOWN	Rainforest Alliance	Colombia	Farming Practices, Environmental conditions	Rainforest Alliance farmers use more soil amendments, less 'environmentally unfavorable' fertilizer (urea), anthropod species richness higher
SERNA, 2010	Rainforest Alliance	Colombia	Farming Practices	Rainforest Alliance farmers employ standards related to water quality, agro-chemicals, recycling and solid waste disposal at significantly higher rate than noncertified farms.
TRIMARCHI, 2014	Fairtrade, Rainforest Alliance , organic (separate comparison)	Colombia	Farming Practices, Environmental conditions*	Fairtrade: minimized and safe use of agrochemicals, proper and safe management of waste, maintenance of soil fertility and water resources; less tree diversity than non-certified group. Rainforest Alliance: biodiversity increase large impact, soil conservation and integrated pest management medium positive impact.
JAFFEE, 2008	Fairtrade, organic	Mexico	Farming Practices	Coop has made transition to organic certifications. Now producers link Fairtrade with organic practices. Fairtrade/organic certification: more weeding, terraces, live and dead plant barriers, contour rows. Spill-over effect on conventional farmers, e.g. use of compost
PHILPOTT, ET AL., 2007	Fairtrade, Fairtrade+organic, organic	Mexico	Environmental conditions	No differences in vegetation characteristics or bird species richness, or fraction of forest fauna in farms based on certification.
BARBOSA DE LIMA ET AL., 2009	Rainforest Alliance RA, Fairtrade, UTZ, organic (mixed)	Brazil	Farming Practices	Reduced use of agro-chemicals, recycling, spillover to non-certified farms

3.3. Critique of Existing Approaches

It becomes clear from reviewing the studies in this field that impact evaluations of environmental standards have almost exclusively focused on the *farm-level,* investigating either farming practices or environmental outcomes. In fact, only few studies even mention how certifications alter the (1st or 2nd level)[12] cooperatives' activities in regards to environmental contents (see Table 3). And of those which do, the issue of how the cooperatives' activities in turn influence farming practices was brought up by only three studies, and even amongst these only to a small extent.

Table 3: Studies investigating environmental certification Impacts on the cooperative level

Author, Year	Certification(s) Investigated	Country	Findings	Farm-level impacts discussed
RONCHI, 2002	Fairtrade	Costa Rica	2nd level coop uses Fairtrade premiums for sustainability programs	No
VALKILA, 2009	Fairtrade, partly organic	Nicaragua	Fairtrade Cooperative helped transition to organic certification with help of NGOs. If farmers *only* certified Fairtrade use less agrochemicals, its because of costs, not conviction.	Yes
MENDEZ, 2002	Fairtrade	El Salvador	Fairtrade certification of 2nd level coop has improved 1st level coop managements' knowledge on production and processing issues that affect quality.	No
RUEDA & LAMBIN, 2013	Rainforest Alliance	Colombia	Coop-level: more trainings and assistance, not specified. Certification attracted other support, government and NGO. Farmer level: higher tree diversity, water conservation practices IPM. Record Keeping.	Yes
GARZA & TREJO, 2002	Fairtrade, Fairtrade +organic	Mexico	Tainings about organic practices financed with Fairtrade premium. Goal: Transition to organic certification.	No
ARANDA & MORALES, 2002	Fairtrade, Fairtrade+ organic	Mexico	Membership in 2nd level Fairtrade coop has allowed for participation in Sustainable Coffee program, increased technical assistance. Fairtrade has promoted "improved soil conservation and water management practices [..]". Goal: Transition to organic certification.	Yes
KRUPKA, 2012	Fairtrade	Across continents	Access to training increased, members appreciate trainings*. *Coop administrators answered on farmers behalf.	No

This might be surprising, given the fact that at least for Fairtrade, which is by far the most researched of the certifications, much of the standards specifically address activities at the *cooperative* level. In fact the whole Fairtrade system is based on the rationale that farming practices might "improve" through the cooperative adapting its trainings and services offered to farmers to certain criteria.

To my knowledge in the case of coffee, which is by far the most researched crop in the certification literature (ITC, 2011a), no such study exists which investigates in-depth the impacts of certifications *both* at the cooperative *as well* as the farmer level.

[12] 1st level cooperative: consists of individual members (farmers). 2nd level cooperative: consists of individual 1st level cooperatives and can be thus be described an umbrella organization.

While this has been done in in a coffee cooperative in neighboring Nicaragua, that study was limited to exploring the impact of *social and labour* standards of Fairtrade (Valkila & Nygren, 2010). Evidence of how environmental standards impact both levels is still lacking. Still, there might be reasons for this.

The current focus mainly on farm-level standards and the lack of investigation on how certifications are put into practices at both management and producer level, might be explained by the *recent* emergence of certifications. “There is still a need to establish these systems as a valid form of development, and this has influenced the research to be driven by the need to ‘prove’ rather than to ‘improve’” (ITC, 2011a).

Yet I argue that in order for farmers to benefit from certification in the future, research needs to work towards improving the system at the same time. If studies find that the environmental impacts of certifications are negligible or absent, and this is communicated to the public, these labels might only gain back their credibility when *improving the system* so that environmental standards are effective on-the-ground. This can only be done by exploring how certifications operate at each level of actors and what are the cooperative- and farmer-level constraints to their efficiency.

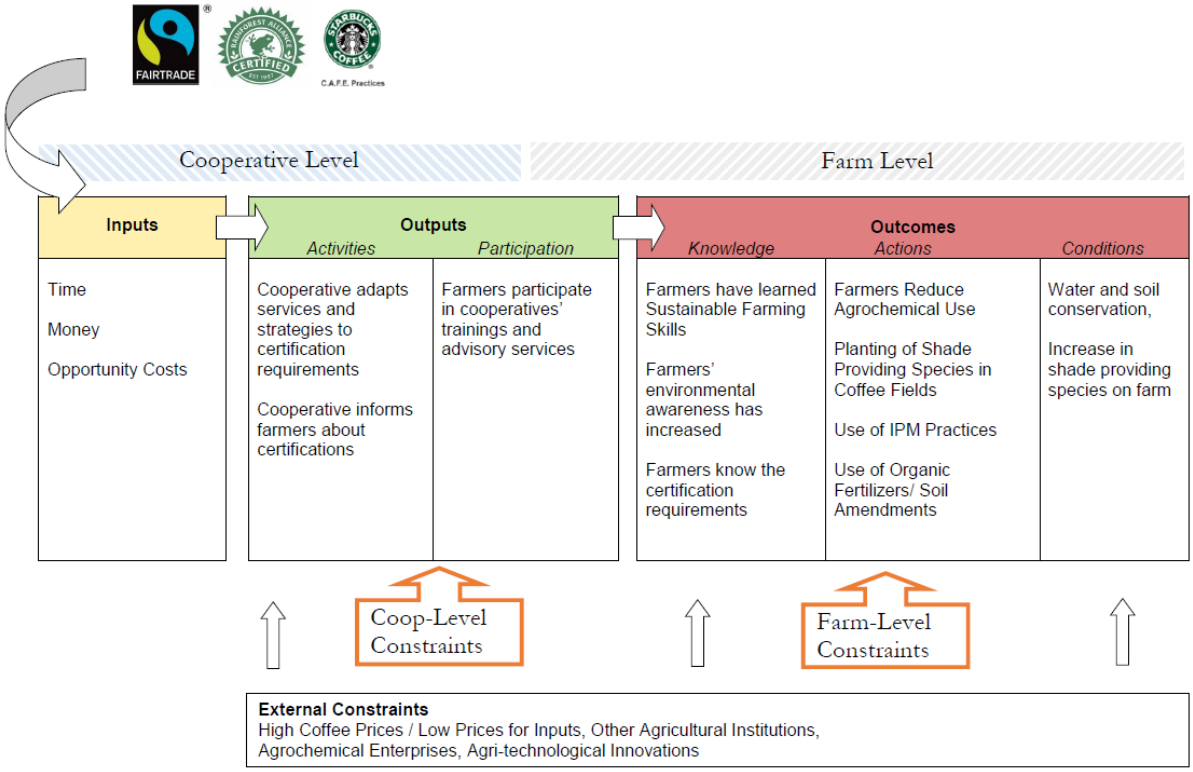
3.4. The Logic Model this Research builds onto

According to The U.S. National Institute of Food and Agriculture (NIFA), a logic model “provides the fundamental framework on which […] evaluation strategies are based” (NIFA, 2015). The model I developed aims to provide the reader an understanding of what certification aim to achieve and *how* they are thought to reveal their impacts.

Figure 1 below depicts the logic model I built this research on and can be seen as a process description, depicting the expected process from “certification” until “the environmental impact reveals”. It was developed by combining the logic model of NIFA (NIFA, 2015) with the program action model suggested by The University of Wisconsin’s Extension Department (UW-Extension, 2014), and adapting the combined model to this specific case.

Besides the process following the certification event, in the model I also point out factors *external* to the system which I think influence the success of the certification program. Per definition, these are factors that cannot be changed by cooperative managers or farmers. These factors are thought to be crucial in influencing the impact of certifications, yet they are largely beyond the scope of this study which explicitly focuses on the *farm*- and *cooperative* level. In consequence, I will in my analysis mainly include constraints on these two levels into the analyses (Figure 1). One exception will be agrochemical enterprises which I include into the analysis as an illustrative example to demonstrate how external factors can interfere with a sustainable coffee production.

Figure 1: Logic model used in this study



Based on the model I formulated not only the Objective and Research Questions as presented in the Introduction, but also the Methodology as described in the next Chapter.

4. Methodology

In this section I present and justify the study design used to answer the research questions (Section 4.1). To set the frame for this report, I then describe the study area (Section 4.2) and the two cooperatives I visited (Sections a 4.3). Section 4.4 deals with the methods I used for data collection followed by Section 4.5 which depicts the major imitations of data collection. Section 4.6 contains information about the methods used for data analysis and Section 4.7 discusses the major limitations to data analysis.

4.1. Study design

Private standards still constitute a relatively new area of research and there is still significant debate on the methods that should be utilized to assess its impact (ITC, 2011a). As the assumption was that farm-level outcomes of certifications largely depend on how the cooperative manages certifications, I included two different cooperatives in the investigation to compare them. Furthermore, I picked two *adjacent* cooperatives in order to keep variations in external factors, such as agro-ecological conditions and communal policy, to a minimum.

For the purpose of describing the complex environments in which certification standards are put into practice at both cooperatives, a *mixed-methods case study* design was most appropriate.

According to Swanbourn (2010), a case study may be defined as "the study of a social phenomenon carried out within the boundaries of one or more social systems." It may be carried out "by collecting information afterwards with respect to the development of the phenomenon during a certain period" (Swanborn, 2010). When considering the certification of producer cooperatives a "social phenomenon" and the two cooperatives I visited "social systems", this definition applies undoubtedly to the quest of this study.

Compatible with the case study design is the Mixed-Methods approach (Yin, 2009). It includes per definition quantitative as well as qualitative methods for data collection and analysis (Creswell, 2011). Quantitative methods were used to reflect changes in farming practices. By employing qualitative methods on top of quantitative ones, I could integrate farmers and cooperative administrators' views of the situation which I would have been unable to express in quantitative terms.

4.2. Description of the Study area

Both cooperatives are located in Tarrazú region[13], San José district, Costa Rica. By linear distance, the cooperatives' mills (*beneficios*) are located only around 9 km away from each other (see Figure 2).

Figure 2: Location of study area within Costa Rica and distance between study sites

Note: Costa Rica Map derived from United Nations Geospatial Information Section in July 2015; Distance between Study Sites derived from GoogleEarth.

Tarrazú region is famous for its coffee, which is widely acknowledged for a favorable taste profile and a well-balanced acidity. In Tarrazú, coffee is grown at high altitudes, low temperatures and high UV-exposure. The consequence is a slow ripening process resulting in coffee beans with only little water content. This, together with the fact that, as generally in Costa Rica, only *arabica* varieties are cultivated, contributes to the outcome that coffee from Tarrazú area fetches higher prices than average on the world market.

[13] There seems to be a general confusion about the term used to describe the study area. ICAFE uses "Tarrazú" and "Los Santos" interchangeably when referring to 1 of the 7 coffee growing regions defined in their reports. Both are geographical, not political classifications. Tarrazú, as the area will be refered to in this report from now on, is the term most commonly used by farmers and cooperative managers. It must not be confused with Tarrazú *canton*, which is a political classification.

The favorable growing conditions and the demand for high-quality coffee from Costa Rica have made Tarrazú, which remained largely unsettled until the mid-19th century, home to many coffee farming families.

Today, of the 7 main coffee growing regions in Costa Rica, it is the one with the by far highest production (ICAFE, 2012). Coffee is the main income source for people in the area and 84% of the landholdings (*terrenos*) in Tarrazú are occupied by coffee cultivation (INEC, 2007).

One of the downsides of coffee production in Tarrazú is its environmental outcomes. In the area, coffee is grown on very steep terrains. During the rainy season, which lasts from May until December (Salazar, 2008), rainfalls are usually very intense. As a consequence, erosion occurs and over time much of the fertile top soil is being washed away by rains. At times of heavy rain, even landslides can become a problem (Figure 3).

Figure 3: Examples for erosion outcomes (Pictures taken in Llano Bonito area during fieldwork)

4.3. Description of the two Cooperatives[14]

Coope Tarrazú, is the larger of the two cooperatives as it has 2900 members. Coope Tarrazú was amongst the first Costa Rican coffee cooperatives when it was founded in 1960. Like for other cooperatives, farmers hoped to be able to hold against private coffee buyers, who at that time earned a big share of the profits. The cooperative has its own coffee mill (*beneficio),* where the coffee is washed, de-pulped, fermented and dried. The roasting mostly takes place abroad. Of the two cooperatives, Coope Tarrazú is financially better off and managed to diversify its activities, which reach beyond coffee production. Today, the cooperative has its own grocery stores, agrochemical supply stores, a gas station, a repair service and a hardware store, all service of which are not only used by members of the cooperative. In 2012, 45% of its income was from sources other than coffee.

Coope Tarrazú has a strong focus on research and development and they are currently experimenting with alternative energy sources, the employment of a bioreactor, the production of juice and many other projects. They also have their own laboratory for soil analysis and work on a soil map for the whole region. Today, certifications have become an integral part of the cooperatives' sustainability image. In 2003, Coope Tarrazú started to offer Rainforest Alliance certification only to some of the members (120/2900), because the Cooperative manages Rainforest Alliance as *individual*

[14] This section is a joint description of observations and discussions from own fieldwork and data collected in 2013 by Anna Snider, mainly from Interviews with coop administrators.

certification[15]. Since 2004 the cooperative is also certified Fairtrade and C.A.F.E. Practices, which are both managed as *group certifications.*

Llano Bonito, is with its 640 members the smaller of the two cooperatives. It was founded in 1972 for the same purpose of maximizing the farmer's profit shares from coffee production and processing. Llano Bonito too has its own coffee mill and, in contrast to Coope Tarrazú, a small roast house. Yet, the latter one is mainly used for supplying members with the ready-to-consume coffee produced from their own harvest as the largest part of the coffee is still sold and exported in its green, unfinished state. During the past couple of years, Llano Bonito has been facing some financial struggles and the prices paid to the producers have been lower than at Coope Tarrazú the last 2 years. Llano Bonito does not own any supermarkets or alike, which might be due to the fact that the place is much smaller than where Coope Tarrazú is located. For soil testing, the agronomist collaborates with a governmental agricultural service nearby where he brings the soil of members to be analyzed. Besides the lack of capacities at Llano Bonito, the most striking difference I found to Coope Tarrazú was the strong coherence within the cooperative and between members and the management. This was also given utterance to in the minutes from one of the assemblies in which the cooperative was referred to as "the big cooperative family of Llano Bonito" (*la gran familia cooperativa de Llano Bonito*)".

Llano Bonito got first certified Fairtrade in 1999, as part of the 2nd level cooperative[16] COOCAFE (=Cooperativas Cafetaleras Guanacaste y Montes Oro), which currently consists of 9 cooperatives in total, spread out all over Costa Rica. All member cooperatives are together certified Fairtrade through COOCAFE, which means that only the coffee exported via the 2nd level cooperative can be sold under the Fairtrade label, but not the coffee directly sold by the individual coops. In turn, to ease the process of getting certified, COOCAFE provides assistance for implementing and running certifications to its member cooperatives. These also include trainings offered to farmers, held in conjunction with the individual cooperatives. Besides Fairtrade, Llano Bonito is also certified C.A.F.E. Practices since 2006. As with Tarrazú, both Fairtrade and C.A.F.E. Practices are managed as group certifications.

The main characteristics of both cooperatives are depicted in Table 4 below.

Table 4: Main characteristics of the two cooperatives

		Coope Llano Bonito	**Coope Tarrazú**
Members		640	2900
Area covered [ha]		1200 ha	6000 ha
Elevations at which coffee is grown		1100-2000m	1100-1500 m
% of certified coffee sold as certified coffee*	C.A.F.E.	4%	22%
	Fairtrade	60%	36%
	Rainforest Alliance	-	83% **

*not all the certification-compliant coffee is necessarily sold under the certification. Depends on demand for certified coffee.
**data from 2014. Unless not otherwise indicated, data are from 2013.
I did not calculate the average size of the landholding, because the number of members is higher than the number of farms. This is because sometimes more than one person in a farming household is member at the same cooperative.

[15] Group vs. Individual Certifications: *Group certifications* involve all the members at a cooperative, as each and every farmer participates in certification. *Individual* certifications imply that only some of the farmers in a cooperative participate in the program. However, in both cases the initiative and certification efforts stem from the cooperative management.

4.4. Methods of Data Collection and Sampling

"Everything that can be counted does not necessarily count; everything that counts cannot necessarily be counted" Albert Einstein

4.4.1. Stage 1: Understanding the Context

In order for fieldwork to be efficient and also to create a base for a meaningful discussion about certifications with farmers and administrators, I applied the following methods.

Before going to the field, I carried out an extensive study of relevant literature. I furthermore learned about the certification requirements of each of the three certifications investigated by reviewing the official guidelines.

For optimal efficiency of actual data collection in the field, I intensely studied Spanish in advance. This was very important in order to avoid interpretation bias (Kirkpatrick & van Teijlingen, 2009) and also for creating rapport with farmers and cooperative administrators. English is barely spoken in the study area, even amongst the cooperative administrators.

Ultimately before the start of fieldwork I met Anna Snider for a 3-days-workshop in order to mark out my study from her work and define research goals. Stemming from an exchange about her last years' experiences in the field, I was able to develop the original research questions.

Another workshop followed with Nicole Sibelet. Her valuable year-long experience with Costa Rican coffee cooperatives and the study area, as well as her anthropological view on things helped shaping my approach of fieldwork.

4.4.2. Stage 2: Collecting Data

Interviews with Farmers

The chosen method for capturing the farmers' perceptions about the impact of certifications was a survey employing structured questionnaires with open and closed questions, leaving room for discussion (Sibelet et al., 2013)

The Questionnaire was structured into three main parts (see also Appendix I).

The first part consisted of some general questions concerning farmer characteristics and cooperative membership, sources of information, as well as questions about the participation in certifications and the understanding of the certification concept.

The second part of the Questionnaire focused in-depth on the participation in trainings and farm visits by the cooperative as well as other institutions. However, results were barely integrated into this report, as in most cases there was no *observable* pattern between participation in trainings and farming practices.

The third part was used as a means to record changes in farming practices and reasons for these changes in a detailed way. This way I wanted to find out how certifications as compared to other factors have influenced farmers' decisions to change practices.

In total, I conducted 50 Interviews with farmers. All Interviews were conducted in Spanish.

Sampling for Farmer Interviews

In order to make the sample as representative as possible given the limited resources (see also 4.5: Limitations of Data Collection), I opted for a 3-stage sampling approach.

In the first stage, with the help of the agronomist at Llano Bonito and the field manager at Coope Tarrazú I selected 2 geographical clusters ("cooperative areas"). The first cluster was Coope Tarrazú area, where mainly Coope Tarrazú members are located and the second one was Coope Llano Bonito area, where mainly Coope Llano Bonito members are found.

As a second stage, I used a stratified sampling approach. Each of the "cooperative areas" consists of several, geographically spread, communities. I divided each of the two areas into their "geographical strata", meaning that, on the map, each cooperative area (Coope Tarrazú and Coope Llano Bonito respectively) was divided into the different communities it consists of. This was done with the help of the agronomists and knowledgeable persons within the study population.

The original idea was to define the number of participants within each community according to the size of the community, so that bigger communities would be represented with more votes. I used this second sampling technique to account for differences between the communities, such as agro-ecological conditions, access to trainings, distance to the coop etc. The purpose of this was to capture the heterogeneity within each cooperative and to make the sample more generalizable for the coop as a whole.

The third stage opted for random sampling to select study participants within each community. Since there was no household map or registry available, I distributed the selected households as best as possible across the community area, so that even households at a further distance to the main road were included (see also section 4.5: Limitations of Data Collection). For the selected households, I then knocked doors asking to talk to the person in the household, who makes farm management decisions.

Because of time and transport limitations, even though the sample was fairly proportionate in relation to the different communities as described above, the sample was disproportionate in relation to the total size of each cooperative. Even though Coope Tarrazú has around 5 times as many members as Llano Bonito does, at Coope Llano Bonito area, I talked to 26 people and at Coope Tarrazú area, to 24. The limitations to this sampling approach are further discussed in Sub-Section 4.5. For exact geographical distribution of samples in the two areas see Appendix II.

Interviews with Cooperative Administrators

In order to investigate the impact of certifications from the cooperative managements' point of view, I had several discussions with employees at each of the two cooperatives. The persons I talked to are all involved in the certification process at their respective cooperative in some way. The interviews varied in structure and content, depending on administrators' positions (see Table 5, next page). However, they were all conducted with the goal of understanding how the different certifications have affected the cooperatives' activities and to what extent changes in farming practices can be attributed to certifications.

Table 5: Description of interviews conducted with administrators at the two cooperatives

	Position	Responsibility in regard to certifications	Method Description	Content discussed
LB	Agronomist	Communication and enforcement of certification requirements. (Planning and conduct)	Semi-Structured Interview	Evolution of Farming Practices in the Study area, drivers for changes, role of certifications in driving changes.
			Open Discussion	Evolution of Trainings offered by the Cooperative, Influence of Certifications on Coop Activities
			Open Discussion	General Activities and Profile of the Cooperative
CT	Field Manager	Communication and Enforcement of certification requirements (Planning and conduction).	Semi-Structured interview	Cooperative's sustainability strategy, Impact of certification on cooperatives' activities and farming practices.
CT	Agronomist	Communication and Enforcement of certification requirements (conduction)	Attendance of 5 Field visits to Farmers. Open discussions on the way.	General contents and approach of field visits. Connection between agronomist and farmers.

Interviews with other Key Persons

In order put the quest about certification into a broader social context, I conducted two open interviews with key persons. These persons were considered important because they have some general knowledge about the farming community as they were considered observers of community developments.

The first key person was a wage labourer, who has been working in the area for 17 years. It was his task to conduct all sorts of farming practices on behalf of a variety of land owners. He was thus considered knowledgeable about general developments in farming practices and the impact of certifications on farm management.

The second key person was one of the younger farmers who also held a position in the educational committee at Llano Bonito. He was considered knowledgeable because he was very integrated in the community, very engaged in a lot of activities related to farming, and thus thought to have a good overview of current and future developments, including certifications.

Participatory Observation

To better understand the context in which the study is conducted, I joined Llano Bonito community members in their everyday activities whenever possible. Since I was staying at Llano Bonito throughout the study period, because of limited resources, this was not possible at Tarrazú to such a large extent. Amongst the activities were the visit of coffee farms, a church visit, joining the meetings of the local women's group, visiting technical talks held at the cooperative as well as various stays at the local "meeting point", which was a snack bar (*Soda*). This way, I for example often witnessed how farmers were talking to each other about farming practices.

Since I was staying in Llano Bonito throughout the study period, people got to know me. This was very important in order to establish rapport with farmers, so they were open to talk to me when I approached them for interviews later. Especially after joining one of the biannual member meetings at Llano Bonito, people were much keener on talking to me than they were before.

Unfortunately, participatory observation at Tarrazú area was limited due to the fact that I was only able to go there for day trips. For a deeper understanding of the limitations to data collection see 4.5.

Review of Internal Documents

The review of Internal Documents is an important contribution to case study research. Yet, in the case of investigating the impact of certifications, we felt that this was a sensitive quest because the cooperatives might not want to completely reveal their activities on the management as well as farm level to "outsiders". In the end, we managed to obtain training records from both cooperatives as well as digital copies of PowerPoint presentations of farmer trainings held at Coope Llano Bonito. This was thought to provide some evidence on the cooperatives' activities in regard to certification requirements.

Secondary Data Collection

In 2013, Anna Snider went to visit most of Costa Rican cooperatives and talked to administrators about the impact of certifications. Even though her focus was rather a socio-economic one, she collected some useful data on the cooperatives' activities as well as valuable contextual information (see also background chapter). Whenever relevant, it is referred to as secondary data in the text.

4.4.3. Stage 3: Feedback

Since I believe it is very important to communicate the findings of the research to the communities involved, feedback sessions with farmers and cooperative managers were planned at both cooperatives. Besides a contribution to the community, I consider the feedback session a method of data collection since it gives the opportunity for farmers to add information. Furthermore, feedback sessions are considered an important way of validating the research findings, because study participants are asked whether or not they agree with the findings.

However, we could only conduct a feedback session in Llano Bonito, because this was refused by the contact person at Coope Tarrazú (see 4.5). The session took place at Llano Bonito's roasting house. It was organized in conjunction with the agronomist and Anna Snider, who also presented her findings about the socioeconomic impact of certification. 10 farmers and the agronomist participated.

4.5. Limitations to Data Collection

Farmer Interviews and Sampling

Not all of the questions were asked to everyone, depending on the state of the questionnaire, which was developed along the way. Furthermore, it was sometimes inappropriate to ask all of the questions. Some of the study participants were very old and had troubles to stay focused. Sometimes people were very tired after work.

Farmers were only available to talk to in the afternoon, when they came home from work and often I felt I needed to hit a certain time window after they had taken a rest from work, before dinner time. While this was not much of a problem at Llano Bonito since I was living nearby and could use the mornings for preparing fieldwork, Tarrazú was much of a challenge in that sense. Because public transport is very poor in the area, I often left Llano Bonito at 5 in the morning and then spend hours on bus stops or in local *sodas* while either waiting for the next connection to any distant community in Tarrazú area, or until farmers came home from work. Often I was "on the road" all day, with the result of having conducted 1 or 2 interviews. This is why I only managed to cover a relatively small sample size, even though having invested much time in farmer interviews.

Yet the main limitation to successfully conducting the farmer interviews at Coope Tarrazú was another one which was more related to sampling. The field manager at Coope Tarrazú which was Anna's and my designated contact person, was quite skeptical towards our research. He expressed in a conversation that he felt it was his responsibility to protect farmers from being bothered by researchers, as he felt especially the RA certified farmers are being "overstudied". In other words, he didn't want us to randomly knock on farmers' doors. Instead, he asked me to only conduct interviews when accompanying one of the cooperatives' engineers on his field visits to farmers (see methods section).

This sampling method had three major constraints: First of all, the participants have been selected by the coop staff, which made the sampling strategy less random. Yet I decided to include the interviews into the analysis, because actually the farmers interviewed were not necessarily "flagship" farmers in terms of fulfilling certification requirements. Second, this method was extremely time-consuming, even more than taking public buses. In the end, we at most had one field visit per day, sometimes no visit at all. Third, I barely ever had enough time to do my interviews completely, because the agronomist wanted to leave and sometimes joined interviews, which limited the questions I could ask, especially the ones related to the cooperative.

After having conducted only 4 interviews within one week like this, I decided to go my own way and knocked on doors to talk to farmers, despite the field officer not wanting me to do so. In the end, I had taken two different "sampling rounds": The first one, with and the second round without the agronomist.

Even though the sampling strategy I had (2nd round) was not completely random either, mainly because I could not go to very distant houses (I had to take the last bus home), the sample was at least not influenced by the cooperative management. Still I almost completely omitted to talk to farmers in and around San Marcos, where the cooperative' mill is located, because cooperative staff was all around and I didn't want to cause offence to the management (especially not in the name of CATIE or future students). Nevertheless, in the end I could manage to conduct 24 interviews in Tarrazú area in total, as good as possible spread out throughout the different communities.

Another limitation in regard to sampling was the big size of Coope Tarrazú combined with the time and transport limitations I did not foresee. The original idea was to adjust the number of participants within each cooperative area to the size of each cooperative ('proportionate stratified sampling'). Yet this was impossible to realize in the limited time I had for conducting fieldwork. This is why, even though Coope Tarrazú has almost 3000 members and LB only around 600, the sample size for each of the 2 cooperatives was around the same in the end.

Interviews with Cooperative Administrators

It was hard to get through to talk to the administration at Coope Tarrazú. The administrators are very busy, and Anna and I were relegated from one to the other. I would have had many more questions, and the time the management appointed us (which was 1 hour of talking to the field manager for both Anna and me), was too little I felt. Nevertheless, the field work Anna conducted in 2013 helped adding some more information to my findings.

4.6. Methods of Data Analysis

4.6.1. Analysis of quantitative data

Because of the small amount of farmers I interviewed, once broken down by subgroups, observations at hand for statistical analysis easily become very small. I thus decided to focus on *descriptive* statistics and mainly employed what are so-called "measures of central tendency". These mainly comprise means and proportions. These measures were in the vast majority of cases compared between two sub-groups (e.g. Rainforest Alliance certified vs. non-certified farmers).

When comparing I decided, because of the small number of cases, to use non-parametric tests. I decided to do so because they have the advantage of being distribution free (Garson, 2012). Furthermore, they allow for appropriate statistical testing even at smaller sample sizes. I used the Mann-Whitney U Test for comparing independent sub-samples, e.g. when comparing Rainforest Alliance certified vs. not Rainforest Alliance certified farmers. For dependent samples (paired observations gained from retrospective questions, e.g. before/after comparison of the same group), the Wilcoxon Signed-Rank Test was used.

Only in two cases (see Section 5.4) have I calculated bivariate correlations statistics. Most of the variables are measured at nominal or ordinal level. Measurements at interval or ratio levels are the exception rather than the rule, restricting severely the use of measures of association/correlation offered in statistical literature. The two correlations I computed used the Spearman Rho Test, because it is applicable to ordinal measurements. For all the tests mentioned, I specified the minimal level of confidence 95% ($p<0.05$). For any statistical analyses SPSS (IBM) was used.

4.6.2. Combining quantitative and qualitative data

The questionnaire contained a plethora of open questions with multiple response options for study participants. In order to make the statistical analysis of such data possible, they had to be transformed into quantitative data. This was done by first categorizing ("coding" in SPSS) responses and then counting frequencies. But there are many cases in which qualitative data have not been transformed. Qualitative information, especially quotes, was used to shed more light, often from a different perspective, to one and the same phenomenon which has been quantified before (Triangulation). Second, whenever quantitative methods failed to do so (see section 4.7: Limitations to Data Analysis), qualitative data was used to connect findings in a heuristic way. This was very important for suggesting some *potential* pathways for mediation of certification impacts across the different levels of my logic model.

4.7. Limitations to Data Analysis

Statistical Inference

Although, keeping in mind my rather restricted resources, I have tried to optimize study design and data collection, it is obvious that in addition to other factors the small sample size poses severe limits not only on the range of statistical tools applicable, but on statistical inference as well (Tabachnik & Fidell, 2013). I applied distribution-free significance tests and used the standard statistical confidence limits. But significance tests depend on a number of factors among which are variability, sample size and representativeness of sampling. Some of the observed differences turned out to be insignificant, others significant. This is what I accept when interpreting results, well knowing that significance tests under the conditions at hand are just a hint. Observed differences in means, proportions or strengths of correlations will nevertheless be interpreted as *not* accidental.

This strategy might be debatable, considering the challenges faced with sampling. Hence to gain further evidence I confront results gained from drawing statistical inferences (i.e. positive significance tests) with qualitative information collected, whenever feasible.

Statistical Controls for Confounding Variables

Because of the small sample size (n=47 at maximum), *statistical* controls for potentially confound variables are hardly possible (Siddiqui, 2013). There is no way to apply multivariate techniques, as for example, logistic regression or other variants (Wunsch, 2007). Even for bivariate correlations, which I only rarely used in the analysis, controls for a third variable through comparisons of sub-table correlations (Garson, 2012), was not feasible.

Sample Composition

The original idea was to compare how the two cooperatives implemented certifications and also look for differences in farming practices between members at both cooperatives. But as turned out later, some of the farmers interviewed were members at both cooperatives. Or members of the same household were members at different cooperatives and frequently exchanged about practices and cooperative matters. Hence there was an overlapping influence from both cooperatives. This is why I, in the end I had to construct one main big sample (n=47) consisting of exclusive Coope Tarrazú members (n=21), exclusive Llano Bonito members (n=16), members of both cooperatives (n=9), as well as a member both at Coope Tarrazú and another cooperative (n=1). For data analysis the "big sample" was most frequently used, if not otherwise stated in the results sections. Furthermore, of the 50 farmers interviewed, data from 3 farmers had to be omitted, because the farmers were either only members at other cooperatives (n=1) or without cooperative membership (n=2).

Retrospective questions

Some of the questions I posed to interviewees were retrospective, basically questions on changes on farming practices over time. It is widely known that such questions are of limited validity (Pearson, 1992), since biases in recall may lead to distorted answers. Panel surveys have been developed to avoid such problems. Yet, given the scarce resources this was not considered an option. When judging these findings it is therefore important to keep in mind the limited validity of results concerning analyses of changes over time.

5. Results

In this chapter I will present the findings from fieldwork. It will be structured along the Research Questions posed in the Introduction as follows: First I describe the Impacts of different Certifications on Farming Practices, as experienced by farmers (Section 5.1). Second follows a description of how certifications have affected the cooperatives' services offered to members (Section 5.2). Third, I depict to what extent there has been a "greening" in agricultural practices amongst study participants and discuss how this may relate to the impact of certifications through the cooperatives. (Section 5.3). Fourth, I point out some of the main farm- and cooperative-level constraints that impede environmental sustainability in coffee production as aimed for by certifications (Section 5.4).

5.1. Impacts of Certifications as experienced by farmers

➔ Research Question 1

In this section I explore how farmers have experienced the impacts of the three different certifications Fairtrade, C.A.F.E. Practices and Rainforest Alliance on Farming Practices. The data mainly stem from the questionnaire survey. The section is split into three parts as I first make a distinction between Group and Individual Certifications (Sub-Sections 5.1.1 and 5.1.2) and later summarize what I found in Sub-Section 5.1.3.

The basic characteristics of study participants are depicted in Table 6 below.

Table 6: Main characteristics of survey participants (n=47)

	Age [Years]	Education [Years of Schooling]	Farming Duration	Duration of Decision Making [Years]	Farm Size [ha]
Ø	52.4	5.5	36.2	26.3	4.9
SD	13.4	2.8	14.4	14.8	5.5
Min	23	0	5	3	0.25
Max	82	12	65	56	27.5
n	47	42	47	47	41

Note: Ø=Arithmetic Mean, SD= Standard Deviation

5.1.1. The Impact of Group Certifications

Even though at **both cooperatives**, 100% of all farms are certified Fairtrade as well as C.A.F.E. Practices, farmer's awareness of this was very low.

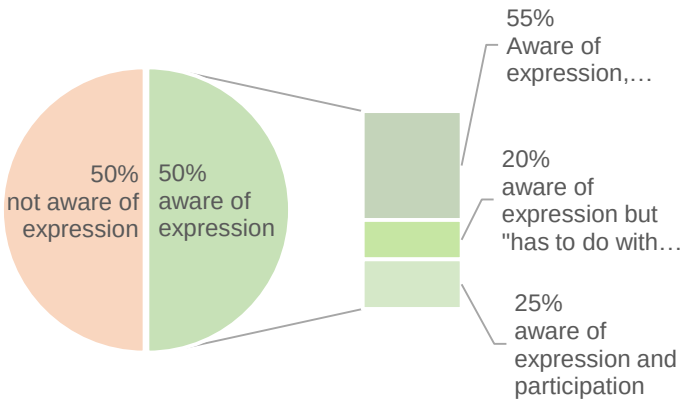
Only 50% of the certified farmers (20/40), being either members at Coope Tarrazú and/or Llano Bonito stated to have either heard the term "Fairtrade" or its Spanish equivalent (*Comercio Justo*) from somewhere.

As for C.A.F.E. Practices, familiarity with the term was much lower, as not even 20% of farmers (6/40) were familiar with the expression.

Yet the awareness of the fact that farmers *participate* in certifications was even lower than the *awareness* of the terms. As this finding might be unexpected to many, I will now investigate the farmers' understanding (or lack of understanding) of the Fairtrade concept in detail. I will only do this for Fairtrade as the awareness of C.A.F.E. Practices certification was too low to be analyzed in detail.

The majority (55%, 11/20, dark green block) of certified farmers who knew the expression Fairtrade or its Spanish equivalent from somewhere were convinced that neither themselves nor the cooperative is certified (see Graph 1)

Graph 1: Fairtrade certified farmers' awareness of certification



Graph includes Information about the Awareness of the term Fairtrade and awareness of being certified Fairtrade. Total n (certified farmers) =40. Composed of exclusive members at Coope Llano Bonito (n=16) and Coope Tarrazú (n=17) respectively, as well as members at both Cooperatives (n=6), and one member at CoopeTarrazú and Coope Dota (n=1).

Many of the farmers who knew the expression from somewhere knew it from meetings held at either of the two cooperatives. From participation in one, I know that Fairtrade is regularly addressed at least during the biannual assemblies at **Llano Bonito**. This is most likely also the case at **Tarrazú**, as according to the Fairtrade regulations, once a year members need to vote for how the Fairtrade premium is put to use. While I know that this is the case at Llano Bonito, it became clear from participatory observation that the majority of farmers attending the meeting are not aware of the Fairtrade voting process. On the other hand, according to the agronomist at **Llano Bonito**, there are talks held specifically to inform members about what Fairtrade is. I do not know if this is also the case at Coope Tarrazú. Anyway, it became clear that even if the cooperative tries to keep members informed, they are not.

Besides the restricted awareness of the term Fairtrade (or *Comercio Justo*) that I found, the survey furthermore revealed that the transmission of the *meaning* of the concept, from the cooperative administration to its members, is very poor.

For example one member, frequently visiting Llano Bonito talks mentioned that she has heard both group certification expressions (FairTrade and C.A.F.E. Practices), but still did not know of her participation in these programs. The concept of certification seemed distant to her. "There was a course [connected to FT certification] from some Canadians here [at the cooperative] three months ago, I went there, but I did not understand what it is."

The *second group* of farmers who know the expression associated certification only with the coop management level (20%, 4/20, medium green slice) and stated to not be involved in any sense themselves. These 4 farmers associated it exclusively with coffee prices, coffee quality or terms of trade but not with anything related to the farm-level. Like one farmer from Coope Tarrazú when referring to Fairtrade certification expressed "the cooperative handles this internally […] they are the ones in charge of commercializing it [the coffee]".

The insignificance of certifications as influencers of farming practices, as experienced by most farmers, is further underpinned by the findings from key person interviews. Both a wage labourer, who has for 17 years put the farm management decisions of many different landholders to practice, as well as a younger farmer, usually up-to-date in many farm-related matters, could not point out any specific changes on the community level, due to certifications.

However, there was a *small group of farmers who knew* they themselves were certified Fairtrade (8% in total, 5/40). These farmers had a higher education than the farmers who were not aware of that they are certified. (Mean years of schooling: 7.6 years vs. 5.3 years, Mann-Whitney-U: -1.996, $p<0.05$, n=37). Another factor which positively affected the awareness of Fairtrade certification was the number of trainings usually visited per year at the cooperative(s)[17], even though only almost significant (3.0 vs. 1.9 talks/year, Mann-Whitney-U: -1.764, p=0.078, n=34)

Nevertheless, for the group of farmers who knew they were certified, the farm-level consequences of certifications in terms of how farmers changed their practices were not straight-forward. See Table 7.

Table 7: Farm management changes due to group certifications, as mentioned by farmers who knew they were certified Fairtrade on their farm

	Member at	**Referring to [Type of Certification]**	**Changes for Certification**
1	Both coops, but referring to LB	Fairtrade and C.A.F.E. Practices	Less herbicides/pesticides, use water channels, shade. Special kind of shade trees, 10% have to have fruits for birds. Explains that "only a small group of people follows recommendations", and amongst these farmers "the knowledge has been there before certifications". He adds that apart from this small group of people "people aren't open for changes"(referring to environmental practices).
2	LB only	Fairtrade	No specific changes, coop says what to change during reunions, but recommendations not specific for certifications
3	LB only	Fairtrade	No herbicides. Use shade. What to do in terms of management practices they are told by the engineer during technical talks.
4	CT only	Fairtrade and Rainforest Alliance*	Same requirements for both certs: don't use Paraquat (red label), more trees/management of trees different, native tree species (fruits for birds), e.g. *dama, guitite, guayaba* (common names). Live barriers (*vetiver, zacate, limon*).Changes started 6-7 years ago [Observatory note:at the time he was certified RA].
5	Both coops, but refers to LB	Fairtrade	"Organic herbicides", no more *Rango* (=Glyphosate) because prohibited by certification [note: not true]. Pay minimum wages "but there is persons which don't pay the minimum wages". Don't throw out trash, recycling program of the coop (refers to LB).

Note: n=5. *Impacts of the Individual certificate 'Rainforest Alliance on Farm Management will be discussed in the next section.

[17] Since the analysis also includes farmers, who have memberships at two cooperatives, I added up the number of talks they normally visit at each of the cooperatives, in case they went to talks at more than one cooperative.

Looking at how the awareness of certification influences farming practices, I could not observe any clear differences between Fairtrade certification-aware and -unaware farmers. One exception to this was tree diversity, whereby the number of different tree species was significantly higher amongst farmers who knew that they are certified (see Table 8).

Table 8: Differences in farming practices between certification-aware and certification-unaware farmers

	Not aware of Fairtrade Certification		Aware of Fairtrade Certification			Mann Whitney U		
	Mean	n	Mean	n	Difference in Means	U	Significance	Total n
Fungicide Frequency	3.5	34	3.5	5	0.03	-0.511	0.610	39
Herbicide Frequency	1.4	33	1.0	5	0.44	-0.819	0.413	38
Fertilizer Frequency	2.9	34	2.7	3	0.23	-0.554	0.580	37
Number of Tree Species*	3.2	35	4.4	5	1.08	-2.034	0.042*	40

Note: n varies according to Variable investigated (see table). Certification Awareness/Unawareness relates to Fairtrade Certification

As for the Use of Integrated Pest Management (IPM) Practices and soil amendments, the prevalence was generally low amongst farmers (see 5.3.5 for detailed description) and not dependent on awareness of Fairtrade certification.

The next sub-section will now deal with the Impacts of Individual (=Rainforest Alliance) certification, of which farmers were actually aware.

5.1.2. The Impact of Individual Certification

As described in Section 4.3, some of the farmers at **Coope Tarrazú** are besides Fairtrade and C.A.F.E. Practices also certified Rainforest Alliance. At the time fieldwork was conducted, Llano Bonito did not offer Rainforest Alliance certification to its members.

Yet Rainforest Alliance certified farmers do not necessarily have to be Coope Tarrazú members, as they are either certified through Coope Tarrazú or through Volcafe, a private transnational intermediary in the area (see Box below on the next page).

Volcafe as a provider of Rainforest Certification

*The Swiss-based coffee trader **Volcafe** is one of the biggest coffee merchants worldwide. Since 2005, it supplies Nestle with green coffee beans from Rainforest Alliance certified farms from the study region, as part of the '*Nespresso *AAA Sustainable Quality™ Program'. It offers courses and technical assistance to certified farmers to ensure they comply with certification requirements. In contrast to the cooperatives, it does not offer community-based services to farmers (profit sharing, loans, sale of agrochemicals etc.).*

Farmers can be members at Coope Tarrazú, but still be certified Rainforest Alliance through Volcafe. But farmers being RA certified through Coope Tarrazú cannot sell their harvest as certified Rainforest Alliance to Volcafe or the other way around. Rainforest Alliance certified Farmers at Volcafe personally receive a price premium, in contrast to farmers certified through Coope Tarrazú where the management announced that there is no price premium for RA certified farmers. Instead, price premiums paid by RA buyers are distributed amongst the coop members, who consequently all receive the same price for the coffee their produce[18]. Yet, the cooperative offers some non-monetary benefits exclusively to Rainforest Alliance certified members, as will be described in the next Section (5.2).

Of the 47 farmers at the two cooperatives, 9 (19%) were individually certified Rainforest Alliance on top of the group certifications Fairtrade and C.A.F.E. Practices. 4 of them were certified through Volcafe and 5 through Coope Tarrazú [19].

As for group certifications, I was interested in how farmer characteristics (age, education etc.) influence the likelihood of being certified individually. I found that RA-certified farmers are significantly younger (Mean 41.2 vs. 55.1 years, Mann-Whitney-U: -2.747, $p<0.05$, $n=47$). They are also higher educated (Mean 7.9 vs. 5.0 years of schooling, Mann-Whitney-U: -2.060,$p<0.05$ $n=42$).

There are hints that farmers selected for RA certification already address some of the standards asked for by certification before. One farmer noted when asked for what he had to change for certification: " […] since 5 years (when he started farming) I am working like that, I studied agro-ecology so I am trying to incorporate what I know into my farming." Another one explains: "There have always been trees and live barriers [on his farm], I just had to increase the number a little bit in some places." And also Coope Tarrazú's field manager confirmed this as he mentions that "a base must be given in terms of how the farm is set up in order for a farmer to be certified RA.

Concerning the influence of *individual certifications* on farming practices, I could in contrast to *group certifications* farmers have to a much higher degree experienced impacts. This is because farmers were *aware* of that they are certified and could directly point out the changes they made in terms of farm management due to certification, if they made changes at all.

[18] According to a public announcement seen at the cooperative's offices

[19] From now on I will treat them as one group, since the sample size is too small to analyze differences between farmers certified RA through Volcafe and farmers certified through Tarrazú.

As seen from Table 9, it becomes clear that the 66% of RA certified farmers have changed farm management practices in order to meet certification requirements, whereas only 33% mentioned to have not made any changes.

Table 9: Farm management changes due to individual certification as mentioned by certified farmers (n=9)

Type of Change due to Certification	Mentioned by [Proportion of Individually Certified Farmers]	
	n	Corresponding %
No management changes	3/9	33%
Management Changes	6/9	66%
Of which Increased Vegetation Barriers	5/6	83%
Stopped using a certain Type of Agrochemical	3/6	50%
Reduced the amount of Agrochemicals	2/6	33%
Increased the number or diversity of Shade Trees	2/6	33%

The most common change was the increase of vegetation barriers, which was pursued by 83% of the "changers" (5/6). Of these 83%, 40% (2/5, not shown in table) have even newly introduced vegetation barriers (other than trees, not shown in table) to their farming systems. The second most common change due to RA certification was the elimination of certain *types* of agrochemicals, a herbicide or an insecticide respectively, done by 50% of the "changers". Furthermore, 33% of "changers" stated to have reduced the *amount* of agrochemicals used because of certification, more specifically the amount of herbicides. The same proportion of farmers increased the number and/or diversity of shade trees for this purpose.

Paradoxically, last years' application rates of Fungicides were significantly higher amongst RA certified farmers. Other than that there were no significant differences concerning the use of agrochemicals or the number of tree species between individually and not-individually certified farmers (see Table 10).

Table 10: Differences in farming practices between Individually certified and non-individually certified farmers

	Non-Individually certified		Individually certified			Mann-Whitney-U		
	Mean	n	Mean	n	Difference in Means	U	Significance	Total n
Fungicide Frequency*	3.3	37	5.5	9	2.18	-2.222	0.027*	46
Herbicide Frequency	1.5	35	1.3	9	0.22	-1.207	0.261	44
Fertilizer Frequency	2.9	35	2.9	9	0.07	-0.895	0.492	44
Number of Tree Species*	3.4	38	4.3	9	0.91	-0.897	0.386	47

Note: n varies according to variable investigated (see table). Individual Certification relates to Rainforest Alliance Certification either through Coope Tarrazú or through Volcafe.

Concerning organic practices, I could not observe any significant differences between RA and other farmers. The use of organic IPM practices amongst RA certified farmers was mainly restricted to the pruning of shade trees to minimize pest occurrence by altering the microclimate. This was a common practice also amongst non-individual certified farmers. The Use of Compost was slightly but not significantly higher for individually certified farmers. 62.5% (5/8) of RA certified farmers and 42% (15/36) of non-RA certified farmers used compost.

5.1.3. In Short: Impacts of certifications as experienced by farmers

It became clear from the data depicted in this section, that for *group certifications*, farmers are not directly involved in the certification process and that the requirements of certifications as such are not known to them. Directly observable impacts on farming practices are thus very small. In contrast, for *individual certification,* impacts could be discerned. The most important change was the increase in vegetation barriers. There are hints for a selection bias in which farmers who already comply with some of the standards are selected into RA certification by the cooperative. Despite the low awareness and the poor understanding of the *group certification* concept amongst farmers, we cannot necessarily reason that there is no effect on farming practices. In fact, we found some evidence that certifications reveal their effects in a rather indirect way, through affecting the cooperatives' activities, as will be described in the next Section.

5.2. Impact of Certifications on the Cooperatives' Services

➔ Research Question 2

In this section we will present how certifications are thought to *indirectly* influence farming practices. The section is divided into three sub-sections. After a short common introduction, in Sub-Section 5.2.1 and 5.2.2 I discuss the impacts of certifications on the two cooperatives' activities as perceived by coop administrators. I explain how each of the cooperatives has integrated certification requirements into its strategies *in the face of an already ongoing discourse* on farming practices and how certifications may be considered amplifiers of this process. Sub-Section 5.2.3. then wraps up the findings.

Today, both cooperatives have integrated sustainability contents into their strategies. Referring to the 2014's lists of trainings from both cooperatives, around 20-30% of the talks held at the cooperatives explicitly dealt with sustainability-related topics, based on the title of the talk (see Table 11).

Table 11: Proportion of talks containing sustainability subjects held at Coope Tarrazú and Cooper Llano Bonito

	Number of Talks			
	at Coope Tarrazú		at Coope Llano Bonito	
	%	**n**	**%**	**n**
explicitly containing sustainability-related topics *	19	5/26	32	6/19

Source: cooperative training records from 2014

Yet, from discussions with administrators at both cooperatives it became clear that the impact of certifications on the services offered to farmers are not as straight-forward as expected. This is because certification requirements are in accordance with a general discourses on environmental sustainability in coffee production which were already ongoing at both cooperatives at the time certifications were introduced.

5.2.1. The Impact of Certifications on Services at Coope Tarrazú

According to their recently published homepage, **Coope Tarrazú** aims at "Promoting a culture of sustainable production amongst producers, families and the community through the implementation of good agricultural practices, the elimination of toxic products used in production, improvement of the carbon footprint [while] helping producers adapt to the *standards and requirements of certifications.*" (CoopeTarrazú, 2015).

Elsewhere the Cooperative declares itself as being "committed to the development of a sustainable production culture" as well as "the protection and improvement of environmental conditions." (Coope Tarrazú, 2014b)

The field manager at Coope Tarrazú, when asked for exactly how the different certifications have influenced the services the cooperative offers to farmers mentions that "They all require talks about occupational safety, about soil conservation and erosion control as well as about foliar nutrition and root systems." He describes the process of adapting the cooperatives activities to certification requirements "a continuous process". For example has the cooperative started to give talks about Climate Change and *La Roya in* 2013*,* as certification requirements have changed. Concerning the question whether the different certifications impact the cooperative in different ways, he explains that the three certifications are handled in a very similar way by the cooperative. According to him, there are many common criteria demanded by all three certifications (FT, RA and C.A.F.E.). "They are almost the same" he says.

Yet he, who coordinates all farmer trainings as well as field visits and certification audits, remains reluctant or unable to point out clear changes that were brought about by certifications. Instead, he emphasizes that the sustainability content of the talks required by certifications fit into the overall strategy of the cooperative. He explains that the talks mentioned above "are not specific to certifications", but rather content-wise fit into the broader objective of the cooperative, who's official slogan is 'CoopeTarrazú - solidary and sustainable' ("Solidaria y Sostenible"). He specifically referred to the cooperatives' own sustainability program, which drawing from another interview with the manager for speciality coffees at Coope Tarrazú started even shortly *before* certifications were introduced.

The sustainability program includes the use of the coffee skin (*cascara*) for energy production at the coop level as well as the production and distribution of organic fertilizer made from coffee pulp to its members. The sustainability program furthermore directly targets the farm-level, as it seeks to promote sustainable agricultural practices (Coope Tarrazú, 2014b) These "good agricultural practices" , as called by the coop management, consists of 5 pillars, of which 3 (Shade Management, management of weeds/manual weeding and Protection of Flora, Fauna and Waters) coincide with the certifications' environmental guidelines (Fairtrade Itl., 2011a; SAN, 2010; Starbucks Coffee Company, 2014)

And also the manager for specialty coffees at Coope Tarrazú sees the link between certifications and the cooperatives own strategy as she expresses that certifications "are very similar to our work" ("*nuestros trabajos"*)[20], referring to the programs of the cooperative." She moreover explains the direct link between certifications and the program when mentioning that certifications provide the *funds* required to realize some of the projects of the coops' overall sustainability strategy. Drawing from the conversation with Coope Tarrazú's field manager, Rainforest Alliance has a more clearly defined and stronger influence on the cooperative's activities.

[20] Data collected by Anna Snider in 2013 during an interview with the Sales Representative at Coope Tarrazú

This is because Rainforest Alliance certified members, even not getting paid a price premium, receive some non-monetary benefits. These benefits include besides the free provision of protective equipment and special technical assistance also the facilitated access to compost (they receive more compost by the coop than other members). Another advantage mentioned by him is the access to special trainings (talks) exclusively for Rainforest Alliance certified farmers. Even though we do not have information about the specific contents of the RA talks, judging from the SAN standards (SAN, 2010), we assume that these talks have a stronger focus on sustainability contents than the "normal talks" held at the cooperative. However, we do not have data to confirm this.

All in all, in the case of Coope Tarrazú, it is difficult to separate effects of group certifications from a general trend in sustainability which has already existed before. Yet to some extent talks are influenced by group certification requirements and to an even larger extent by Rainforest Alliance certification.

5.2.2. The Impact of Certifications on Services at Coope Llano Bonito

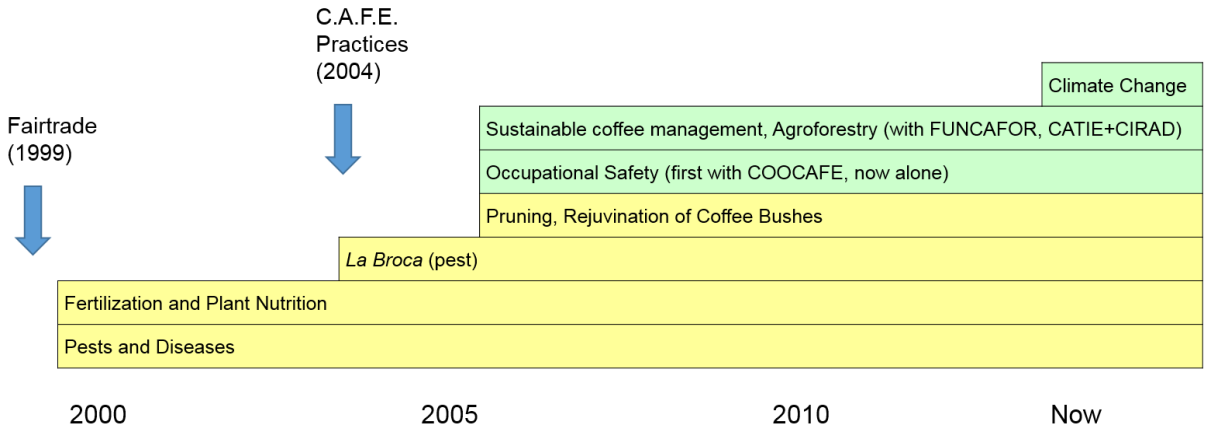
The agronomist at **Llano Bonito** during various discussions pointed out two specific impacts of certifications on the cooperatives' activities.

First, he mentioned that the cooperative stopped selling certain types of agrochemicals to members, as these substances were prohibited "by the certifiers". He explains that due to certification they stopped selling Paraquat (a herbicide) and Fenamiphos (an instecticide) in 2007. This brings up another possible role certifications play, which is the enforcement of already existing laws. Much of the chemicals which are prohibited by certifications are also prohibited by the Costa Rican phytosanitary law. Thus cooperatives might take the role of enforcing national laws, when enforcing "their own". In this example, the sale of Paraquat has been restricted by Costa Rican law to "upon special permission" only. Yet this implies that it can still be sold in agrochemical stores. From participatory observation I know that Paraquat is still used in the study area. Certifications possibly put some more pressure on the cooperatives to encourage farmers stop using prohibited pesticides.

And the pressure is already on as the agronomist explains: "There was a case in which prohibited pesticides were used and then we [the cooperative management] had to prove to FLO that we did not know about this". The consequence was that they as a cooperative had to be re-audited by FLO which generated extra costs for the cooperative. It is obvious that the cooperative wants to makes sure to avoid these costs next time they are audited.

As a second impact of certifications, as it was also the case at Coope Tarrazú, the agronomist at Llano Bonito mentions changes in the content of talks. He explains that environmental and occupational safety topics (marked green) have been integrated into talks from around 2005/06 onwards. Even if these topics started to be dealt with later than more production-related topics (marked yellow), it becomes clear that the at Llano Bonito there is a process happening in which certification requirements are integrated into talks offered by the cooperative (see in Figure 4).

Figure 4: Training evolution at Llano Bonito since the introduction of certifications



Note: based on an interview with the agronomist at Coope Llano Bonito

As it becomes clear from the figure, the focus of the newly developed talks has been shifting more towards environmental/occupational safety topics, as demanded for by certifications. A statement from the agronomist hints that there is a perceived pressure on the content of talks created from certifications as he says “talks about erosion and climate changes are necessary. FLO requires documentation of date, place, the list of participants and the topic [FLO has always required such documentation] ”.

But also at Llano Bonito, certifications were born into an already ongoing environmental discourse. One good example for this is the construction of the hydro-electrical damn ‘*Pirrís*’ which has already started the environmental discourse before certifications were introduced. In the frame of the project, water samples were taken in the valley and analyzed for soil particles from water erosion. According to the agronomist of the cooperative, it was through the results of these tests that people started to realize how much soil is being lost from erosion. “From 1995/2000 onwards, with the electro-hydrological project ‘*Pirrís*’ people began to think of erosion, began to think of the importance of soil. […] there was for the first time information about the loss of soil from water erosion. People began to realize that the soil lost is to be related to the production of coffee.” He added that “the projects and investigations” by *Pirrís* have led to the creation of a “consciousness about the establishment of shade trees to protect rivers and water basins (*cuencas*)”.

He furthermore clearly emphasizes that this consciousness, which he says was “brought from the outside” (“*de afuera*”)” environmental discourse already at a time before certifications. According to the agronomist it was already before certifications were introduced, in 2000, that “people at the coop began to talk more intensely about vegetation cover and shade. Soil conservation practices (and) soil cover implementation, were intensified from then.” At the same time “people started to talk about certifications […] But this information flow was still weak at that time, because in terms of certifications it was only dealt with the issues of water (water use, quantity, quality, protection) […] at that time there was no clear idea about what certifications *meant (“cual era el fundamento real de certificaciónes”)*”.

Yet he underpins that the certifications have helped amplifying the already existing environmental discourse: “In 2005 people and us, the technicians, already had a clearer idea of the value of shade trees, protection of soils and vegetation cover. Certifications helped to generate more information and a bit of conscience (*conciencia*)”. During another discussion he again mentioned the role of certifications in helping generate an environmental consciousness as he said before the certifications “people killed more animals and fell more trees.”

All in all at Llano Bonito, certifications have impacted the content of talks as well as helped enforcing Cosa Rican pesticide law. But also here certifications are to be seen as part of a greater sustainability movement that has already started before the introduction of certifications.

5.2.3. In Short: Impacts of Certifications on the Cooperatives Activities

In this section we have described how environmental sustainability topics have been integrated into the cooperatives' strategies. Both cooperatives have adapted their services offered to farmers to certification standards. However, the impact of certifications on the cooperatives' services is relativized by the fact that already before certifications arrived there has been an environmental discourse at both cooperatives. Yet certifications are thought to have an impact as they can be considered amplifiers of this general discourse.

5.3. Changes in Farming Practices due to an amplified Discourse

➔ Research Question 3

This Section deals with the extent to which farming practices have been "greened" in the area and as to what extent this can be attributed to the impact of certifications through the cooperatives. The section is divided into 6 Sub-sections. Sub-Section 5.3.1 points out the general importance of the cooperative as source of information on farming practices. This is to show that the cooperatives actually reach farmers with their activities, which is a prerequisite for certifications to unfold their effects. Sub-Sections 5.3.2 to 5.3.4 describe the "positive developments" in terms of farming practices since the introduction of certifications with regards to how this can be attributed to certification impacts via the cooperatives. The fifth Sub-section (5.3.5) indicates what practices have *not* been "greened" in the study area, even though this is fostered by certifications. Section 5.3.6 wraps up the findings.

5.3.1. The Importance of the Cooperatives in influencing Farming Practices

In the survey we have, in an open way, asked farmers for their sources of information on advances in farming practices (multiple response). According to the results, some kind of the cooperatives' technical assistance, either the agronomists or technical talks, were by far the most commonly mentioned sources of information (see Table 12).

Table 12: Source of information by membership (multi-response)

Note: Total n=46. Exclusive LB members: n=16. Exclusive CT members (incl 1 farmer who is also member at another coop): n=22. Members at both: n=8.

	Replies from Exclusive LB members		Replies from Exclusive CT members		Replies from Members at both	
	%	Votes	%	Votes	%	Votes
Talks	**29%**	**8**	**29%**	**10**	**29%**	**4**
..Talks/Meetings at Llano Bonito	29%	8	3%	1	29%	4
..Talks at Coope Tarrazú	0%	0	26%	9	0%	0
Engineers	**50%**	**14**	**44%**	**15**	**50%**	**7**
..Engineer Llano Bonito	39%	11	0%	0	29%	4
..Engineers Coope Tarrazú	7%	2	35%	12	21%	3
..Private engineers	4%	1	9%	3	0%	0
External Insitutions	**21%**	**6**	**24%**	**8**	**21%**	**3**
..ICAFE	11%	3	12%	4	21%	3
..MAG	7%	2	6%	2	0%	0
..Volcafe	4%	1	6%	2	0%	0
Total Votes	**100%**	**28**	**100%**	**34**	**100%**	**14**

We can thus conclude that *first*, the cooperatives are in the position to influence farming practices. They are by far the most important sources of information to members, at both cooperatives. *And second*, because farmers are *not* aware of *group* certifications, it must be the cooperatives who make sure that certification requirements are met *without* "labelling" their actions as "motivated by certifications".

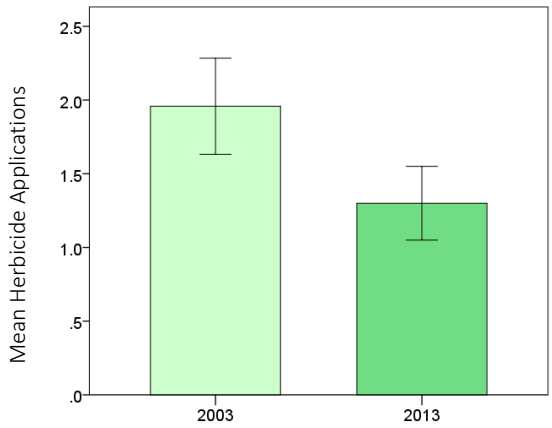
5.3.2. Successful Reduction in Herbicide Applications

The pronounced occurrence of soil erosion in the study area and the decrease in soil fertility and yields that come along with it have affected the nature of farming practices. The agronomist at Llano Bonito explains: "Today, practices of soil conservation are common all over the region."

Drawing from the survey we can observe a clear reduction in the number of annual herbicide applications amongst study participants. Looking at the point in time when the 'reduction wave' of herbicides started, it can be said that the majority of people who reduced the frequency of applications, did so starting 9 years ago (95%, 18/19).

The average number of annual herbicide applications employed by the farmers interviewed clearly and significantly decreased during the past 10 years. Whereas in 2003 the average was 2.0, 10 years after, in 2013, the number had gone down to only 1.3 applications that year (see Graph 2).

Graph 2: Mean herbicide applications of study participants in 2003 as compared to 2013



Note: Excluding farmers who started taking farm management decisions after 2003 and for which consequently no data are available for 2003. Wilcoxon Signed-Rank Test p=0.001, U=-3.416, n=38.

We asked the 41% (19/46) of farmers who reduced the application rate of herbicides since they started making farm management decisions for the reason(s) for this change. The reasons most commonly mentioned by farmers are depicted in Table 13.

Table 13: Farmers' reasons for having decreased herbicide applications (multiple-response open question, n=19)

	Votes	Percentage of Total Votes
Decrease in Soil Fertility, Erosion	10	42%
Advice from Cooperative	6	25%
Harmful to people, coffee plants and /or environment	4	17%
RA Certification (both Volcafe)	2	8%
Advice from Private Engineer	1	4%
Financial Reasons	1	4%
Total	**24**	**100 %**

While the reasons most commonly mentioned by farmers were related to *direct* observations of a decrease in soil fertility or erosion (42% of votes), the second most frequently mentioned reason was the advice from the cooperatives (25% of votes). This was followed by the statement that herbicides were toxic/harmful to coffee plants, people, and/or the environment (17% of votes). Even though direct advice from the cooperatives had "only" around 25% of the votes, it has to be noted that the consciousness of the negative effects of herbicides has not always been present in the area. We know about the importance of the cooperatives in influencing farming practices. For raising awareness within the farming community about the drawbacks of herbicides the cooperatives are thought to have contributed a lot. We are thus convinced that the "real impact" of the cooperatives in influencing farmers' decision to reduce herbicide use is higher than can be directly deduced from the table above.

What the contribution of certifications was in backing up the process of creating awareness can't be answered specifically. Yet the field manager at Coope Tarrazú acknowledges the impact of certifications as he states that they have led to a "decreased use in toxic agrochemicals, (a use) [..] in a responsible way *(de manera responsible)."*

What is clear is that the "reduction wave" in herbicide use started after certifications were introduced. Because certifications have been shown to foster the integration of sustainability related topics into the cooperatives' strategies, we conclude that certifications have at least contributed to the reduction in herbicides by amplifying the ongoing discourse.

5.3.3. Increase in the Quantity of Shade-providing Species (SPS)

Drawing from the farmer survey I could observe a trend in the increase of shade providing species[21] on farms. 47% (21/45) of participants have increased the quantity of shade trees on their farms since they started taking management decisions.

The data moreover indicate that the tendency to plant SPS is a phenomenon that has started *around the time* certifications were introduced. 71% (15/21) of the interviewees that have increased the number of SPS, have not started to do so until 15 years ago, when the "tree increase wave" started.

Unfortunately I do not have data on the absolute quantity of trees. I only know whether or not people have done any changes. It is possible that the ones who have not increased the number of SPS on their farm, have even before already had a lot of trees. Yet we are convinced that the findings described above *indicate* a certain trend towards "more SPS on farms".

The reasons for farmers to increase SPS are closely connected to the type of SPS, as different species provide different services. The most common reasons are depicted in Table 14 on the next page.

[21] Shade-providing species= Shade tree species + Banana species (belonging to *Musa L.* family). I avoid to use the term "shade trees" as from a botanist point of view, banana species are not defined trees, because they do not have a woody stem. Yet, against the botanical definition, farmers mostly considered banana species as "shade trees" (*árboles de sombra*).

Table 14: Farmers' reasons for having increased shade providing species in their farms (multiple-response open question), n=21

	Votes	Percentage of Total Votes
Shade, Fertilizer, Erosion Function	13	46 %
Consumption / Sale of Tree Product	9	32 %
Animal feed (birds)	3	11 %
Climate Change	2	7 %
Certification (both RA)	1	4 %
Total	**28**	**100 %**

As it can be seen from the table, 32% of the reasons stated by farmers related to the consumption or sale of tree products, and the trees increased in this case were either banana or avocado (not shown in table). Certification was a minor reason stated by farmers (4% of all replies).

Yet, the remaining 64% and thus the vast majority of replies referred to the provision of shade for coffee, fertilizer (tree prunings), erosion control, animal feed or climate change. All of the reasons in the latter group are as such part of the rationale behind certification standards.

Yet, it remains unclear to what extent certifications have contributed to the increased awareness of the importance of SPS. This time, in contrast to reasons for herbicide reduction, the cooperatives were not mentioned as drivers for change.

5.3.4. Small Progress in the Use of Soil Amendments

Both cooperatives have, since certifications were introduced, implemented programs in which they facilitate soil amendments to their members. These organic soil amendments consist of either unprocessed Coffee Pulp, being a “waste” product from coffee processing (in the case of Llano Bonito) or compost, which is basically fermented coffee pulp (case of Coope Tarrazú). The coffee pulp/compost is as part of the service available free of charge to members at each of the cooperatives.

Yet the real impact of these programs on farming practices is moderate, as the majority of farmers, 55% (24/44) does not make use of the free products. The reasons for not using this service will be discussed in Section 5.4: Constraints to a sustainable coffee production as fostered by certifications.

The first ones to introduce the soil amendment distribution program was Coope Tarrazú, as part of their sustainability program which started before the introduction of certifications. Yet the prospect of integrating certifications into the overall cooperative strategy might have encouraged the cooperative to implement such a program already shortly before actual certifications. As for Llano Bonito, which introduced the coffee pulp distribution program in 2005 (*after* the first certifications), the joint influence from “competing cooperatives” that already offering this service, the general sustainability movement and certifications is thought to have encouraged the implementation of the program.

5.3.5. The Lack of "Greening" of other Farming Practices

Other than the decrease in herbicide use, the increase in SPS, and the compost/coffee pulp programs I did not observe any changes towards more sustainable farming practices. I now point out those "sustainable" practices, be it the decreased use of agrochemicals or the increased use of organic practices, that are encouraged by certification but have *n*ot improved amongst study participants.

No Decrease in Fungicide Applications

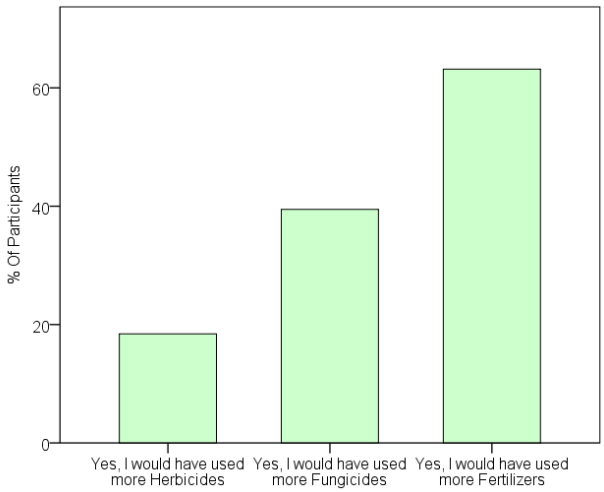
Contrary to what certifications seek to achieve, fungicide applications have strongly increased in the study area since certifications were introduced. This will be discussed in-depth later in Section 5.4.

No Decrease in Fertilizer Applications

Concerning the Use of Fertilizers, I did not observe any changes in the frequency of applications since certifications were introduced. The majority stated to always use 3 applications/year (67%, 34/46). 16% (8/46) said they use 2-3 applications/year and only 6% (3/46) stated to use 2 applications. 1 person (=2%) even used 5 applications/year.

I also found that in the case of fertilizers, the extent of use is not limited by the farmers' awareness of possible adverse environmental effects or soil quality, but rather restricted by *financial* constraints. I asked the participants for each of the three main inputs (fertilizers, herbicides and fungicides) if they would have used more, if the prices had been lower. In the case of fertilizers the majority (62%, 23/37) replied with "Yes" (see Graph 3). For the other two agrochemical groups, the proportion was much lower.

Graph 3: Proportion of participants who would have used more herbicides, fungicides and fertilizers respectively if product prices had been lower



Note: n=37 for fertilizers and herbicides, n=38 for fungicides.

Not much Use of Organic Fertilizers

Only 4% (2/46) of farmers interviewed use organic fertilizers other than compost, coffee pulp or dead plant material. *One* person used cow and chicken manure, as his relatives have an animal production and therefore these arise as a by-product. *Another* farmer, who was exceptional in the way that he was generally very suspicious about agrochemicals, stated to be using chicken manure aside from chemical fertilizers. He said "we [his brothers and him] have seen that it works well in other plantations and also, my father used it." All this suggests a generally low integration and acceptance of organic fertilizer practices in the study community.

The agronomist from LB confirmed these findings as he noted that amongst farmers "there is still a very low use of organic fertilizers, there is not yet 'a good culture' in respect to this approach." In conclusion, the success of certifications in encouraging the use of organic fertilizers amongst farmers is quite limited.

Insignificant Use of organic Integrated Pest Management (=IPM) Practices

Even though this is encouraged by all three certifications, the actual use of organic IPM practices for the control of pests and diseases was relatively low amongst study participants. I asked a proportion of the farmers I talked to if they use other methods than chemical ones to control pests. Only 26% (8/31) of them stated to do so. The types of organic practices employed by people are depicted in the table below.

Table 15: Most common types of IPM practices used (multiple-response, open question, n=8)

	Votes	% of Total Votes
Pruning of Shade Trees	6	55%
Organic Products (bought)	3	27%
Physical Control	1	9%
Biological Control	1	9%
Total	**11**	**100%**

Even though the use of IPM a reported by farmers was relatively low, I think that farmers might not have been aware that they are actually controlling pests e.g. by improving air circulation around coffee plants when pruning shade trees. We can however conclude from the findings that the knowledge of non-chemical methods to control pests is low, even though the actual employment of such practices might be higher.

5.3.6. In short: "Greening" of Farming Practices

Since certifications were introduced in the study area farmers have considerably decreased herbicide applications and increased the quantity of Shade-providing species (SPS). They have furthermore started to use compost/coffee pulp. The described "greening" of farming practices is thought to be mainly the result of an amplified sustainability discourse. However, in the case of SPS, the reasons for an increase also extended to the direct benefits that can be accrued from consumption and sale of tree products (avocado, banana).

How exactly this development relates to the introduction of certifications remains unclear. Nevertheless, from Section 5.2 we know that certifications have enhanced the cooperatives' focus on promoting "green practices". Because the cooperatives are the most important sources of information for farmers, as shown in this section, certifications are thus thought to have affected farming practices *via the cooperatives*.

The greening of other farming practices than the ones mentioned could not be observed.

.

5.4. Constraints to a sustainable coffee production as fostered by certifications

➔ Research Question 4

In this section I present some of the major constraints for an environmentally sustainable coffee production as fostered by certifications. All three certifications contain guidelines that encourage farmers to use less agro-chemicals and such, which promote the use of organic practices. Yet, there are some constraints at the farm- and cooperative level which impede sustainable coffee farming as aimed for by certifications.

5.4.1. A new Pest

The coffee leaf rust ("*La Roya"*) is a plant disease evoked by a fungus (*Hemileia vastatrix*) affecting coffee plants and which has led to tremendous yield losses in South-and Central America during recent years. "*La Roya* has been in the country for 37 years" explains the agronomist at Llano Bonito and also in scientific literature *La Roya* has been reported in Costa Rica already in 1983 (Schieber & Zentmyer, 1984). Yet the infection with the fungus remained small for a long time and an epidemic spread of the disease all over middle America and Mexico has only taken place from 2012/2013 onwards (Avelino et al., 2015).

In Costa Rica, the disease first occurred in lower altitudes where temperatures are higher but has meanwhile also reached Tarrazú region, where coffee is grown at higher altitudes ranging from 1100-2000 metres[22]. "We had strong yield losses because of *La Roya* […]" explains the agronomist at Coope Llano Bonito.

Since the spread of "*La Roya" (Hemileia vastatrix*) in 2012, ways to protect the coffee plants from being affected has become a **main topic** during talks of the cooperatives. "The fungus could develop because the producers weren't aware of what *La Roya* was" says the agronomist at Llano Bonito. "It is important to communicate information about the mixture of products to nourish the plants and to reduce pests and diseases". As a consequence, both cooperatives made the control of the pest a priority of their strategies.

Referring to both cooperatives' list of trainings in 2014, a whole series of talks, especially at the beginning of the new farming cycle (after the harvest), was implicitly dedicated to *"La Roya".* The importance of *La Roya* during talks was confirmed by a quick survey amongst a small group of farmers, mostly exclusive Llano Bonito members. All of the 12 farmers interviewed stated that pests and diseases have been a main topic during the talks they attended. Drawing from Coope Tarrazú's list of trainings held in 2014, this relative focus on pests observed at Llano Bonito also applies to talks at CoopeTarrazú (Coope Tarrazú, 2014a). Moreover, 2 of the 12 farmers from the quick survey, who had visited both talks at Llano Bonito and Coope Tarrazú, confirmed that the importance of *la Roya* during talks was equally present at both cooperatives.

Also the government promotes the use of fungicides to control the pest. In the beginning of 2013 the Costa Rican government called La Roya an emergency and encouraged farmer and producer organizations to react by increasing the application of agrochemicals (Government of Costa Rica, 2013)

As a result of the increased pest pressure combined with the extensive communication of the importance to use fungicides in order to control the pest through the cooperatives, farmers reacted by starkly increasing fungicide applications.

[22] According to interviews with representatives from both cooperatives conducted by Anna Snider in 2013.

Comparing 2012 and 2013 fungicide applications, the majority of farmers interviewed increased the number of applications from one year to the other or even started to use fungicides when not having used them before. Table below depicts the farmers' reaction to *La Roya*.

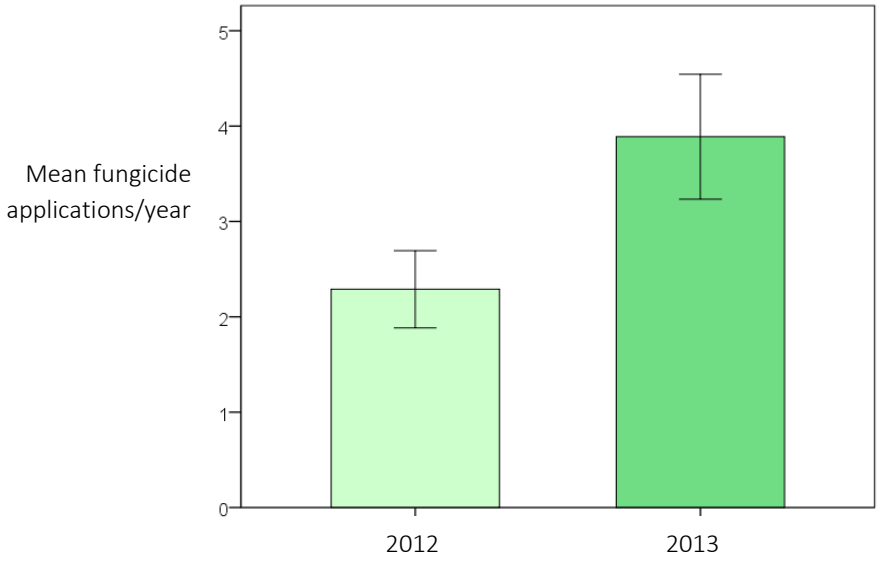
Table 16: Farmers' reaction to *La Roya*.(n=45)

Increased Fungicide applications *since 2012*		Started using Fungicides *since 2012*		Same Fungicide application rate as before		Abandoned Coffee Farming	
%	N	%	n	%	n	%	n
44%	20	11%	5	42%	19	2%	1

55% (25/44) have increased the number of fungicide applications, of which some (5/25) have not even used fungicides at all before *La Roya* occurred. Only one farmer (2%, 1/45) has decreased the number of fungicide applications. This farmer reported an increasing pest pressure on his farm starting already in 2012. This together with having found an alternative income source as a carpenter made this farmer abandon coffee farming all in all. The remaining 42% (19/45) have not drastically increased the number of applications due to *La Roya* from 2012 to 2013.

According to data from the survey, farmers all in all sharply and significantly increased the number of fungicide applications/year from an average of 2.4 applications in 2012 to 3.8 applications in 2013 (see Graph 4).

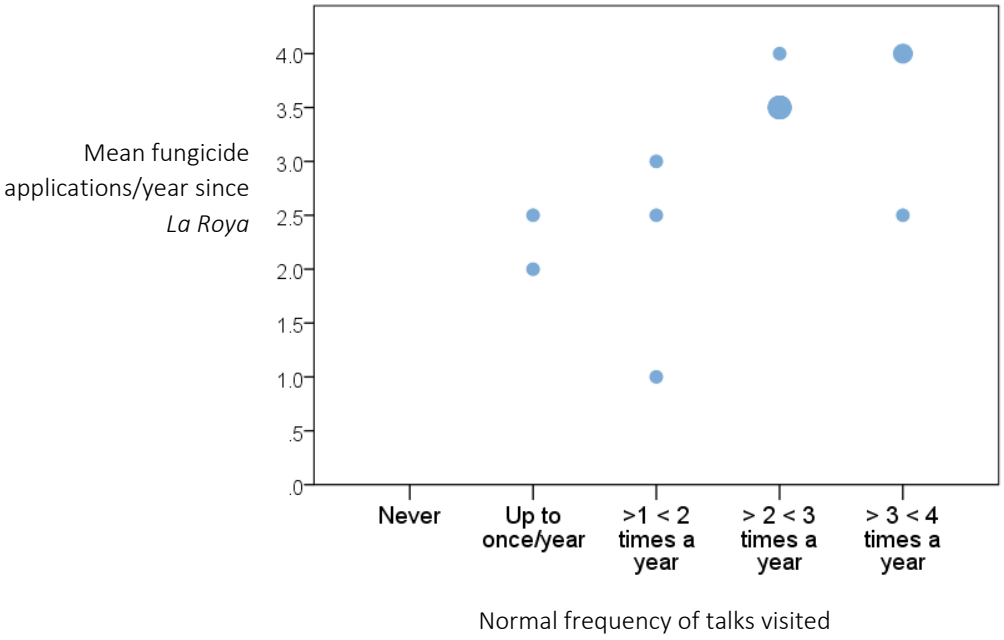
Graph 4: Mean fungicide applications before (2012) and after (2013) the outbreak of *La Roya*



Wilcoxon Signed-Rank Test. U=-4.407, p<0.001 n=45

At Llano Bonito, there was as significant positive correlation between number of talks visited last year and *frequency of fungicides applied*. This means that people who visited talks more often used significantly more applications of fungicides than the ones who visited less. This possibly underpins the role of the cooperative in encouraging the use of fungicides in the situation of an increased pest pressure. See Graph 5 below.

Graph 5: Mean number of fungicide applications 2013-2014 (since *La Roya*) according to participation in talks



Note: Only includes data from exclusive Llano Bonito members/talks. n=12. Participation refers to frequency during "normal year". Big blue dot: n=3. Medium blue dot: n=2. Small blue dots: n=1. (Spearman Rho Correlation: 0.699, p-Value: 0.011)

However, this result might be interpreted wrongly as the farmers visiting trainings might be the ones who generally tend to use more fungicides, even beforehand.

Altogether, this sub-section shows that the occurrence of a pest has been a significant farm- level constraint of sustainability in coffee production as aimed for by the certification initiatives. It is important to know that even though all three certifications encourage a minimal use in fungicides, none of the standards have set precise limits to the use of agrochemicals. A pest such as *La Roya* might completely negate the combined ambitions of certifications, the cooperatives and farmers to reduce the use in agrochemicals. As one farmer expressed: "People use chemicals for everything, that's very bad […]. I haven't used fungicides for 40 years, I don't want to use much, but nowadays it is necessary to fight *La Roya*."

5.4.2. Productivity vs. environmental sustainability

Generally, the cooperative management has to balance two *conflicting* directions of influence. On one hand, both cooperatives are trying encourage environmentally sustainable farming practices, but on the other hand they want to optimize yields, a goal which can only be reached employing a high use of inputs in the case of coffee.

The agronomist at **Llano Bonito** expressed: "The fundamental issue is how to increase productivity […] how to improve soil quality *(el suelo*) […] now they [the farmers] are improving productivity after some years with decreasing productivity. Nowadays they produce 22 *fanegas/manzana* (local measurements), but 35 *fanegas/manzana* are possible. […]Right now for me the focus is on [..] all activities, all the research projects, all the actions […] which facilitate what is production, productivity." In the context of productivity, he talked about the importance of adapting fertilizer strategies to changing weather conditions. But he also emphasized the importance of making people deploy fungicides to secure the yield: "This year the people understood that it is necessary to preventively apply fungicides, the incidence of *La Roya* has already decreased."

Also at **Coope Tarrazú**, increasing productivity forms an important part of the cooperatives' strategy. According to their new webpage, amongst the "key aspects" of the cooperatives' work with farmers is "to improve the productivity on our members' coffee fields through trainings, transfer of technologies, research, breeding [and] technical assistance (CoopeTarrazú, 2015)." Moreover, when looking at the 2014 trainings list of Coope Tarrazú (Coope Tarrazú, 2014a) one might start to doubt the sustainability approach of the cooperative. The vast majority, 79% (26 /33) of the talks organized by the cooperative were held by representatives of agrochemical enterprises, comprising agrochemical fabricants, importers and distributers. During the field visits I did with the agronomist at Coope Tarrazú, I did not witness any conversation about topics related to environmental sustainability. The topics discussed were all related to the increase in productivity. Furthermore, from talking to farmers but also from discussions with the same agronomist, it became clear that also during field visits Coope Tarrazú collaborates with agrochemical enterprises. These enterprises offer free soil tests to farmers and give personal advice while in turn trying to sell products.

In contrast, the influence of agrochemical enterprises at **Llano Bonito** seems to be lower only judging from last year's list of trainings. According to this, only 3% (1/19) of the trainings were held by representatives of agrochemical enterprises. Yet from participatory observation of how talks are organized at Llano Bonito, it can be assumed that some of the cooperation with agrochemical enterprises has taken place spontaneously and off-record, as planning of talks at Llano Bonito is "improvised" at times. Like the agronomist expressed when talking about organizing talks with coop-external bodies: "I have a cycle of talks, depending the activity, the time of the year [..] some talks have a "dead space" […]I try to (also) take in some space for the ones from commercial enterprises (*casas comerciales*)." He underpinned the complexity of various factors determining the content of talks and hence the composition of presenters when he later added "In the end a lot of information gets mixed." Concerning field visits, there was no hint that the cooperative collaborates with agrochemical enterprises.

All in all, this sub-section suggests that one of the challenges for a "greening" in farming practices as sought for by certifications are the productivity goals of the cooperatives and the embeddedness into agro-industrial networks.

5.4.3. Capacity of the Cooperatives

Probably one of the major constraints to a more sustainable coffee production are the capacities of the cooperatives. At Coope Tarrazú the agronomist-to-member ratio is 1:966, whereas at Llano Bonito it is 1:650. Considering the fact that officially every member can at any time ask for a field visit or an advice from the agronomists, it becomes clear that the time resources of the agronomical service are very limited.

Yet at both cooperatives, it is the agronomists' responsibility to communicate certification requirements to farmers and make sure they pass the audits, because neither Coope Tarrazú nor Coope Llano Bonito have dedicated a full job position to someone managing certifications. According to a field study conducted last year, only 30% of the occupational time of the 'project and certification manager' interviewed at Coope Tarrazú were dedicated to managing certifications. Effort-wise, this was comparable to a 25-30% of the time dedicated to managing certifications at Llano Bonito, as mentioned by the agronomist. (Snider, 2013b, 2013c)

This makes clear that, even if they are doing their best, the overall resources of the cooperative to mediate the potential impacts of certifications are low. This is underlined by a statement from the agronomist at Llano Bonito: "Even though environmental conscience exists, technically it is difficult to pass on the information to producers, because the capacity is lacking."

5.4.4. Farmer's Perception of organic fertilizers/soil amendments

A wide spread opinion amongst farmers which hinders the potential positive effects of certifications is that organic inputs are less efficient that chemical ones. "There are courses about organic things, those are new ideas […] here [in their village] there were people who worked organically, but it didn't work out." Another farmer explains that organic fertilizer is not as concentrated as chemicals "you have to apply a lot". Another one noted: "I only use chemical one (fertilizer). At Coope Tarrazú, organic fertilizer is cheap, but it's not the same, it's not as strong." And also at Llano Bonito farmers complained: "The products they sell are very expensive and not as strong (*fuerte*) as chemicals."

As already discussed in sub-section 5.3.4, both cooperatives have introduced free distribution programs for organic fertilizers/soil amendments. However, the nature of the programs differ considerably between the two cooperatives, which in turn affects the acceptance amongst farmers.

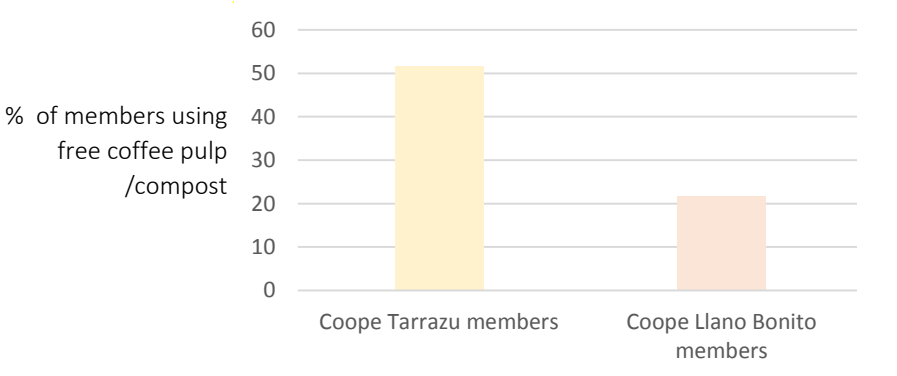
Coope Tarrazú has a well-developed program. They retain the coffee pulp which is a by-product from coffee processing done at the cooperatives' mills (*beneficios)* when the coffee cherries are peeled. The pulp is then processed into compost and the compost packed distributed free of charge to the door of Coope Tarrazú members.

In contrast, **Llano Bonito's** program is less developed and less user-friendly as the pulp is *not* processed into compost by the cooperative. Thus, members have to leave the coffee pulp ferment on their own properties before being able to use it compost. But many members are not willing to do so because the low acceptance amongst the community towards the smell developing during the fermentation process is very low. This hinders people from using the coffee pulp. As one farmer expresses: "We don't apply the compost, because it smells bad. Only the branches from pruning we use". Second, according to the statement of some farmers this is even evoking dengue and thus against Costa Rican Law. One farmer explains: "For this (the fermentation on own property) we need permission by the ministry of health. It smells and attracts mosquitos, dengue. You must have a specific place to put it".

The different nature of the programs has unambiguous effects on the use of coffee pulp amongst cooperative members: more than half of *all* CT members (15/29) use the service, whereas less than ¼ of *all* LB members (5/ 23) make use of the organic fertilizer offered by their cooperative (see

Graph 6).When excluding farmers who have a membership at both cooperatives, the result is even more pronounced. In that case 60% of *exclusive* CT members (12/20) vs. 20% (3/15) of exclusive LB members use the service.

Graph 6: Proportion of members making use of the free compost/coffee pulp offered by their cooperative(s)



Note: Data from all members of each respective cooperatives were used,. *Coope Tarrazú: n = 29; Coope Llano Bonito: n=23.*

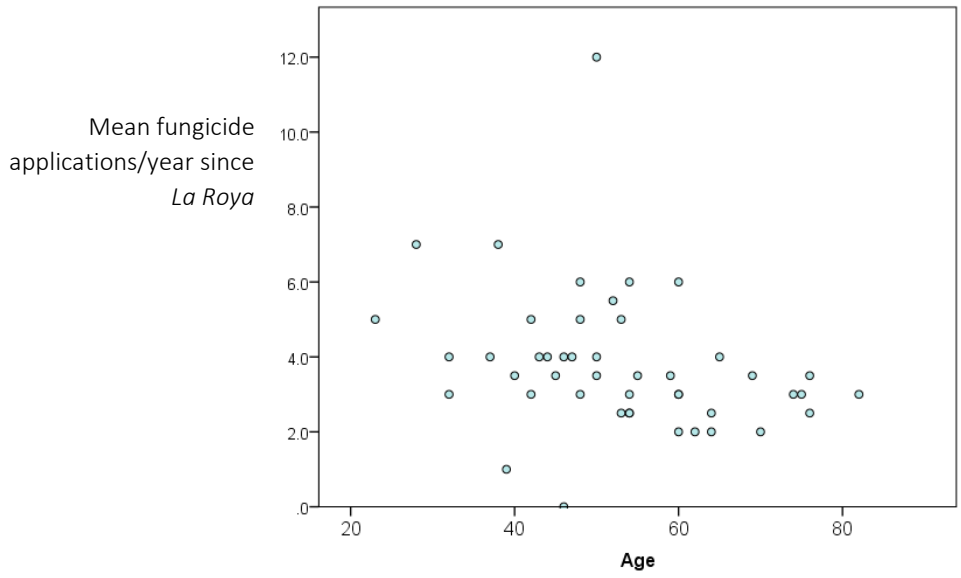
However, it has again to be noted that the nature of the program offered by the cooperatives is not the only reason for farmers not to use soil amendments. This is because, as can be seen from the graph, also at Coope Tarrazú, the acceptance of compost is low, even though it is already processed. The agronomist from Llano Bonito summed up my impression as he noted that amongst farmers "there is still a very low use of organic fertilizers, there is not yet 'a good culture' in respect to this approach."

5.4.5. A new generation of farmers

This paragraph describes characteristics of a certain group of farmers which might be difficult to reach by certifications. Yet this group will be important as they build the future of farming in the region.

Using the Spearman Rho test for correlation, I found that the farmers' age negatively and significantly correlates with the frequency of fungicide applications. Younger people used significantly more fungicide applications since *La Roya* occurred (see Graph 7).

Graph 7: Frequency of fungicide applications in 2013-2014 according to age



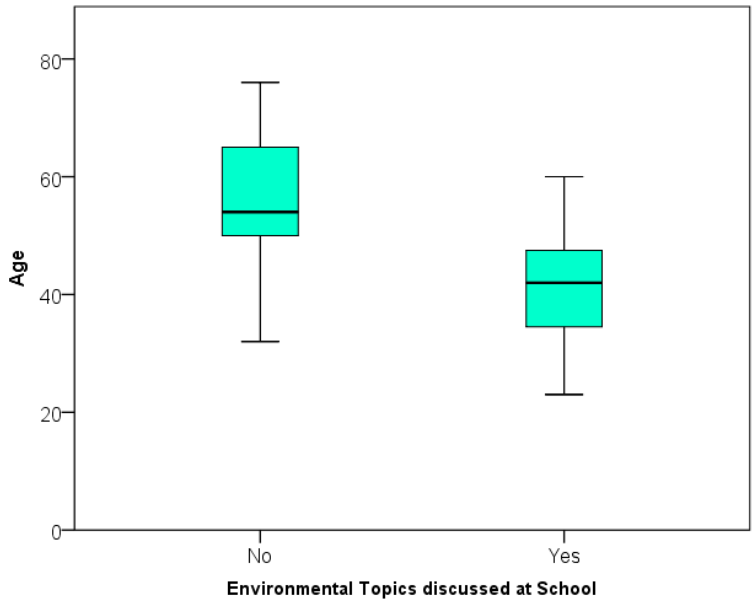
Note: n=46. Spearman Rho correlation: -0.406, p=0.005, n=46

On the other hand, there might be possible confounding factor distorting the picture, which is cooperative membership. I found that farmers at Coope Tarrazú are significantly younger than the ones at Llano Bonito. Thus, differences in fungicide application rates might be related to Cooperative membership rather than age.

However, the finding that *younger* people in general tend to invest more inputs was corroborated during an interview with a wage labourer who had been working for many different landholders in the study for more than 15 years. When asked for the differences between older and younger farmers in respect to farming practices he answered "There are many [..] it's another way of seeing things, the ones with higher age are different. […] Before [referring to older people] they were using what was most convenient to avoid costs." The observation that younger farmers invest more inputs into coffee farming was also corroborated during a discussion with one of the younger farmers who holds a position in the cooperative council at Llano Bonito.

Yet, younger farmers are significantly more likely to have had environmental classes at school than were older farmers. See also Graph 8 below.

Graph 8: Association between presence of environmental topics at school and to age



Note: Depicted are age quartiles according to the presence of environmental topics during class ("Yes") and the absence of environmental topics during class ("No").Median age (black horizontal line): 42 vs. 54 years. Includes n=4 who never went to school. Mann-Whitney U=-3.411, p=0.001, n=37

Summarizing the findings in this Sub-section, I might conclude that there is a new generation of farmers, which use significantly more fungicide applications what could not be prevented by environmental classes at school. It might therefore be difficult for certifications to reach those farmers.

5.4.6. In Short: Constraints for a Sustainable Coffee Production

In this section I have identified some of the main constraints for sustainable coffee production as fostered by certifications. These include on the *farm level* the appearance of a new pest and a new generation of farmers who uses more inputs. Furthermore, there are some perceptional barriers that hinder farmers from using sustainable practices. On the *cooperative level*, possible constraints might be first, the two-fold objective of the cooperative, which has to balance environmental sustainability and productivity goals in the face of an agro-industrial network. Second, a general lack in the cooperatives' capacities impede the dissemination of information about the advantages of sustainable practices to farmers.

6. Discussion

The first part of the overall objective for this study was to "Investigate farm- and cooperative-level impacts of certifications on farming practices". Fieldwork has helped answering "how certifications impact" rather than "to what extent certifications impact". On one hand this is because of the farmers' unawareness of group certifications. On the other hand this is because certifications operate in complex environments of other factors influencing farmers and cooperative managers' decisions about practices and activities. This study provided in-depth insight into the context in which theoretical certification "standards" are put into practice at two cooperatives.

With this background of knowledge, we were able to elaborate on the second part of the overall objective which was to "identify the major farm- and cooperative level inhibitors of sustainable coffee farming as fostered by certifications".

In this Chapter I explain how the findings described in the results section support the hypotheses stated in the introduction. I will also, wherever possible, relate my findings to literature from other study sites. The first 3 Sub-Sections are structured along the 4 hypotheses. Sub-Section 6.1 discusses the farm-level impacts of certifications. Sub-Section 6.2 deals with the pathway of certifications to impact farming practices via the cooperative. In Sub-Section 6.3, I will discuss findings about the constraints for sustainable farming as opted for by certifications. Sub-Section 6.4. includes thoughts about the generalizability of the findings from this study.

6.1. Farm-Level Impacts of Certifications

Hypothesis 1: Most farmers have experienced a "greening" of farming practices due to certifications. Different certifications have affected farming practices in different ways.

This study has shown that in Tarrazú, Costa Rica, the majority of farmers certified Fairtrade and C.A.F.E. Practices are not informed about their participation in the program. Considering "to experience" a *conscious* process, we have to omit the first part of the **first hypothesis** ("Most farmers have experienced a greening of farming practices due to certifications). Because most farmers have *not, at least not consciously,* experienced any changes. As for the second part of the hypothesis, we could confirm that "different certifications have affected farming practices in different ways". The differences I found were regarding to Fairtrade and C.A.F.E. (group certifications) on one hand and Rainforest Alliance (Individual certification) on the other.

6.1.1. Group Certifications: Lack of Awareness

The almost absent awareness of certifications amongst farmers was a finding I did not expect. It seems paradox, that the subjects of the Fair Trade and C.A.F.E. Practices initiatives, the farmers themselves, are not even aware of these initiatives that seek to improve their situation. This is especially surprising with regards to the Fairtrade seal, which has a strong focus on social equity and which explicitly advocates democratic organization and transparency in farmer organizations (Fairtrade Itl., 2011a)..

Yet the awareness issue has been raised in other contexts as well. Fairtrade producers have even been described "passive suppliers of a product" (Utting-Chamorro, 2005). The conclusion drawn from a case study on coffee certification in El Salvador (Mendez, 2002) was: "In general, individual cooperative members and households are lacking accurate information on what fair trade is".

Findings from Nicaraguan, Peruvian and Mexican coffee cooperatives corroborate the awareness issue (Garza & Trejo, 2002; Lyon, 2007; Valkila, 2009). Furthermore, if farmers had an idea about the concept it was reported that Fair Trade was mainly associated with higher prices (Mendez, 2002). It was also found that farmers commonly attribute fair trade benefits to the associations, which manage the certifications, rather than to certification itself (Aranda & Morales, 2002). These findings are very much in line with results from my fieldwork.

It was mentioned the observation that the higher in organizational hierarchy within the cooperative, the better is the understanding of the concept (Garza & Trejo, 2002). Other authors have attributed the low understanding of the Fair Trade concept to a lack of communication between board members and farmers (Garza & Trejo, 2002). In Mexico, researchers interviewed producers at different coffee cooperatives which form part of a 2nd level Fairtrade organization (Aranda & Morales, 2002). They found that even though the 2nd level organization indeed disseminated information about how fair trade works, this information has not reached the farmers. As this situation resembles Llano Bonito's institutional arrangement with COOCAFE, one might think the lack of awareness amongst producers in Llano Bonito is because of the great distance to the 2nd level organization. However, in our case the great distance between the 2nd level organization and individual farmers does not seem to be the main obstacle, as I found that certification awareness was also not higher amongst farmers at Coope Tarrazú, where certifications are managed directly at the 1st level cooperative.

While in this study higher levels of education and a higher frequency of participation in talks were associated with higher awareness of certifications, one of the main constraint to farmers' knowledge about certifications may arise from the cooperatives capacities. I have shown that the agronomists and field managers have to cover a lot of tasks at the same time. Informing about certifications might be important, but not be as high in priority as other issues. This is in line with the findings from one of the studies mentioned above (Aranda & Morales, 2002), where researchers related the low Fairtrade awareness to the huge amount of topics discussed at the cooperatives' meetings and the logical consequence that there is no room for certifications to be discussed.

While this is not necessarily the case for C.A.F.E. practices because of its non-binding nature, the Fairtrade system in a way contradicts itself. Fairtrade demands from farmer associations a democratic organization, in which each farmer has a vote in the decision-making process (Kilian, 2004). Still, the way it has been implemented in the two cooperatives, it can be considered a system in which the cooperative on farmers' behalf has agreed to work towards environmental sustainability in production, without the commitment of farmers.

Concerning differences in farming practices between Fairtrade- aware and unaware farmers, they were not striking. Indeed did aware farmers have a higher tree diversity on farm than non-certified farmers. Furthermore, 3 of the 5 farmers aware of Fairtrade have actually *increased* SPS in their fields due to certification. Still, 1 of the 3 farmers also had Rainforest Alliance certification and might have increased the trees for RA rather than Fairtrade certification, even though he mentioned he did it for both seals. All in all, the indication of an effect of Fair Trade certification on tree diversity is weak. This might have been influenced by the very small sample size and the even smaller size of the group of "aware farmers" (n=5). Research about how the awareness of certification influences the farmers' behavior is needed, as there is no study to compare these findings with.

6.1.2. Individual Certifications: Some conscious changes have occurred

Concerning the Impact of Rainforest Alliance certification, results were clearer to define, as farmers actually knew they were certified. The majority of farmers have made changes due to Rainforest Alliance certifications. However it is not clear whether those farmers who did *not* make any changes, already *before* certification complied with the criteria, or whether they actually do not comply with the criteria now. To investigate this I felt would have been inappropriate. I did not want to confront farmers with a "quasi-audit" to check the compliance with certification standards. This would have been out of the scope of this study and most importantly on the expense of the rapport I created with farmers before starting the interviews. Nevertheless, having triangulated qualitative data from interviews with farmers and the field manager at Coope Tarrazú, this research hints that farmers selected into Rainforest Alliance certification already meet certain criteria before.

Evidence on the "biased" selection of farmers into RA certification comes from Santender, Colombia. The authors explained how the farmer association in charge for certifying individual producers first approached such farmers who already employed organic practices. They also explained that they "targeted first the larger farm owners who could reliably provide a large volume of certified coffee to the market" (Rueda & Lambin, 2013). Whereas in my sample the size of landholdings did not significantly differ between RA certified and non-RA certified farmers (data not shown), the findings from the literature direct a critical view towards the egalitarianism[23] approach of such initiatives. In our case, this did not play much of a role, since the financial premiums paid for RA certified coffee are equally distributed amongst all members of the cooperative.

One of the unexpected findings from this study was related to the use of shade providing species (SPS) amongst RA certified farmers, given that certification guidelines have a strong focus on biodiversity. In my sample SPS diversity did not differ between RA certified and non-RA certified farmers. However, methodological constraints of fieldwork need to be taken into consideration here. Results might have been influenced by a recall bias, in which farmers only remembered the most abundant or, in their view, most important tree species. Furthermore, it is commonly accepted that retrospective data are to be judged with care (Pearson, 1992). In fact from participatory observation my impression was that RA certified farms are very rich in tree species. My data are based on people's perceptions. With more time resources at hand, it would have been advantageous to conduct in all cases farm visits and make a tree diversity assessment (count number of tree species/area unit). Data originating from the latter method are thought to be much more reliable than data generated from interviewing farmers.

Unfortunately, the body of literature concerning the impact of Rainforest Alliance certification on farm-level environmental outcomes is small. Yet existing studies suggest a significant impact of RA certification on tree diversity. Fieldwork conducted in Colombia, compared 30 RA-certified with 30 non-certified farmers and found that the number of tree species was much higher in RA certified farms (Trimarchi, 2014). However, that study did not discuss the possibility that farmers who already comply with standards select themselves into certification. Yet, another group of researchers has published a study from the same area which supports these findings. They specifically asked farmers for changes in tree diversity due to certification found a significant increase in tree diversity (Rueda & Lambin, 2013).

[23] Egalitarianism= a belief in human equality especially with respect to social, political, and economic affairs (definition according to Merriam-Webster)

The reasons for the 9 farmers with RA certification to use more fungicides than other farmers were surprising to me. RA standards have strong focus on farm level regulations and promote the "least possible use of agrochemicals". Of course all farmers have to protect their yields and this is not against any of the certification standards. Yet the number of fungicide applications was particularly high amongst RA certified farmers, higher than the application rate suggested by Llano Bonito's agronomist (data not shown, according to a presentation by him). Thus the question remains whether this can be considered "the least possible use".

A possible explanation for the fact that Rainforest Alliance certified farmers used more fungicides, is ironically related to consumer preferences. For Rainforest Alliance certified coffee beans, quality standards are high and consumer preferences imply that marks and spots on the beans are to be kept at a minimum. In order to avoid pests from damaging the coffee cherry, fungicides serve as an efficient means. It might consequently be the case that consumer preferences for RA certified coffee contribute to an increased use of agro-chemicals in coffee production. Besides all the possible reasoning it is important to remember the small sample size. Results might not be representative of the RA certified farmers in the area.

Concerning the Use of Compost, it is surprising that not all of the RA certified farmers use it, having in mind that the compost is provided by the cooperative free of charge at larger quantities than for other farmers. However, some of the farmers that replied to this question were certified RA through Volcafe which does not provide free compost. Yet these farmers are officially active members at Coope Tarrazú and should therefore have access to compost. One explanation could be that they hand in too little harvest at Coope Tarrazú and since amounts of compost distributed are adjusted to this, they don't receive any.

Fieldwork in Colombia compared RA-certified farms with non-certified farms (n=52 each) for the types of fertilizers used. The study was reviewed and published by RA (Hughell, 2013). In the document it was concluded that "certified farmers use more, in that case, coffee pulp. It is concluded that "certified farmers in that region are managing the soil nutrition on their farms using natural fertilizers rather than synthetic." But we argue that these conclusions lack scientific evidence, because indeed did RA-certified farmers use more coffee pulp, but the difference was extremely small (18/52 for non-certified vs. 22/52 for certified farms). No information was given on applications of chemical fertilizers.

6.2. Impacts of Certifications via the Cooperatives

Hypothesis 2: Because of certifications, the cooperatives have started to integrate sustainability topics into the services offered to farmers.

Both Coope Tarrazú and Coope Llano Bonito started to offer talks about sustainability topics. In addition, both have started to promote sustainable farming practices by offering some kind of compost distribution program to members. In fact, both have *improved* these services since certifications were introduced. This is especially the case for RA where the impacts of certifications on services offered are most evident.

Yet we cannot conclude the cooperatives' services have become sustainability-oriented *because* of certifications. In both cooperatives, there has been a development of environmental awareness creating already before certifications were introduced. This was especially the case for Coope Tarrazú that has started the sustainability course before obtaining certification.

As the concepts go hand in hand, the exact impacts of certifications on coop activities cannot be separated from the impacts of the environmental discourse that has started before certifications.

An exception are some talks that have according to the coop administrators been introduced specifically to meet certification requirements. Still, as it became clear that the cooperatives have not *started* to integrate sustainability topics *because* of certifications, the **second hypothesis** must be omitted. Because the cooperative administrators have pointed out some effects of certifications, mainly regarding changes in talks, we instead conclude that certifications have helped improving the sustainability-related services of cooperatives.

Even though literature concerning the effect of certifications on activities offered by the cooperatives is limited, it has been suggested for the case of Fair trade that indeed one of the main benefits is that it the cooperatives' ability to provide enhanced services to their members (Murray & Taylor, 2003; Raynolds et al., 2004). Case studies from Latin American coffee cooperatives have described the re-directing of FT funds in particular to environmental projects and farmer trainings to be amongst the benefits farmer accrue from participating in certification (Raynolds et al., 2004). In Colombia, in particular RA certified farmers appreciate these benefits from certification, as they state amongst the more common reasons to stay in the RA program the improved technical assistance from their association.

Hypothesis 3: The cooperatives are important sources of information for farmers, e.g. by providing extension services. In consequence, cooperatives are important mediators of environmental standards *as described* by certifications thus 'greening' farming practices.

As for the **third hypothesis**, it can be concluded that cooperatives are indeed important sources of information. Farmers at both cooperatives perceived either talks and/or the agricultural engineers to be the most important sources of information on advances in farming practices. Thus cooperatives are considered important mediators of environmental standards as described by certifications. Moreover, even though this does not apply to *all* practices, in the case of herbicide reduction but also for increasing SPS and to a smaller extent the use of compost, the cooperatives have successfully assisted farmers in "greening practices". Yet it is important to note that the environmental standards underlying the successful greening of practices *as described* by certifications are not necessarily inherent to certifications systems. It was shown before, that these standards form part of a bigger context. This study has shown that the certification standards are in line with the cooperatives own strategies, which are i turn inspired by many other external factors besides certifications.

As already hinted in the introduction, the interrelation between certifications, cooperative and farming practices, which is discussed here, remains largely unexplored. Of the studies that investigate the role of the cooperative in mediating the effects of certifications (see also Table 3) only three are considered eligible to compare to the results of this study, as they take into consideration in their analysis both the cooperative's actions as well as farming practices (Aranda & Morales, 2002; Rueda & Lambin, 2013; Valkila, 2009).

Of the three studies mentioned, one investigated RA certification (Rueda & Lambin, 2013). It was depicted that in Colombia, certification has led to the dissemination of information about sustainable farming practices through the associations' extension service. As a consequence, the author concludes, RA Alliance certified farmers have successfully "greened" their farming practices (IPM, shade trees, water conservation) and mention as one of the benefits from the program the access to trainings.

The second study (Aranda & Morales, 2002) was conducted in Mexico and investigates amongst other quests the environmental impacts of Fairtrade and organic certification. In regards to farming practices it was found that the 2nd level Fairtrade cooperative put resources into the dissemination of organic farming practices, to help farmers convert to organic farming. The outcomes an increased transition to organic production, and, according to the author "improved soil conservation [..] as well as the increased consciousness about the importance of conservation in general". However this is not further specified neither underpinned with quantitative data nor quotations. Again there are some parallels to the Llano Bonito case, in which the 2nd level Fairtrade cooperative (COOCAFE) provides some trainings and other services related to sustainability to the individual member cooperatives (see also 4.3). Yet, the outcome of these programs on farming practices remains largely unspecified as these 2nd level programs have not, at least not under the "certification label" reached the farmers consciousness.

The third study having explored the connection between certification, the cooperative and farmers comes from Nicaragua (Valkila, 2009). While the focus of the study is, again, a socio-economic one, the author explains only marginally how Nicaraguan Fairtrade cooperatives have, in conjunction with financial and technical support of NGOs, supported farmers in the transition to organic certification, a similar case as found in the Mexican cooperatives described before. Yet this study did some farm-level investigations in which fertilizing practices of farmers *only* certified Fairtrade vs. farmers certified Fairtrade *and* organic, were analyzed in detail. Both groups are part of the same Fairtrade cooperative. The author's conclusion was that if the group of farmers *only* certified Fairtrade used less fertilizers they did so because of a lack in financial means and not because of conviction. On the other hand, the organic group was convinced about their practices. Thus it can be concluded that Fairtrade helped some but not all farmers in the cooperative to employ better farming practices in the long run.

6.3. Farm- and Cooperative Level Constraints to Sustainable Farming

Hypothesis 4: Certifications foster sustainable production by encouraging to keep the use of agrochemicals at a minimum and by promoting organic practices. However, cooperatives and farmers generally aim for an optimal production and are involved in agri-industrial networks, including input companies. Thus, the cooperatives' services as well as farmers' strategies might oppose environmental sustainability goals. Besides, the cooperatives' capacities to disseminate information on sustainable farming practices is restrained. Producers, in their actual situation, do not perceive sustainable practices as desirable. Certain producer characteristics impede the environmental sustainability in farming practices.

The findings described confirm the **fourth hypothesis**. I have identified both at farm- as well as the cooperative level some major constraints impeding a sustainable coffee production as fostered by certifications.

First, on the farm level, as farmers aim for a high productivity, the occurrence of La Roya has made the increased use of fungicide applications imperative. Findings have underpinned that the occurrence of a pest can be one of the major farm-level constraints to environmentally sustainable practices.

It is important to note that even though the application of fungicides *per se* is not limited by either of the three certifications, all of them contain standards which explicitly *encourage* to keep the use of pesticides and agrochemicals in general at a minimum. Examples from the guidelines are given in Figure 5 on the next page.

Figure 5: Synopsis of certifications' core standards about the use of agrochemicals

	"Least possible use of agrochemicals". The farm must rotate chemical products and reduce their use for crop production. Certified Farmers [..] work to reduce and eliminate these products, especially the most toxic ones. The farm must demonstrate by comparative agrochemical inventories and use records that it rotates chemical products and reduces their use for crop production. The farm must have an IPM program based on ecological principles for the control of harmful pests. Must give priority to biological control.
	Standards "Promote the use of integrated pest management tools, and aim at reducing the amounts of pesticides used as much as possible." members must be able to demonstrate that pesticides are applied based on knowledge of pests and diseases. Cooperative must provide training on IPM.
	[No requirements. but cooperative collects "points" (preferred supplier list) if on the farm-level:] "Pesticides are only applied as a last resort." "Farm takes physical action to control sources of infestation." "Pesticides (not including herbicides) are only applied as a last resort (after cultural and physical controls have failed)".

Note: as derived from (Fairtrade Itl., 2011a; SAN, 2010; Starbucks Coffee Company, 2014)

While it may be obvious that farmers are obliged to use more fungicides in a situation of pest a major infestation, what is more surprising is the lack of use of *IPM* practices as encouraged by certifications. It is important to note that decreasing the use of agrochemicals on one side and increasing the use of organic practices on the other side can happen independently from each other. Farmers may learn, if not restrained by either the cooperatives capacity, to apply IPM practices on top of only using fungicides.

The lack of use of such organic practices, on top of chemical ones, is in my opinion closely related to one of the cooperative constraints identified, which is the lack of capacity to disseminate information about environmentally sustainable practices. The cooperatives do lack the time resources to promote such practices in a more active way. It has been noted that the lack of capacities is one of the main constraints for the successful dissemination of certification standards. Trimarchi (2014), relating specifically to coffee certifications in Colombia, suggests that for certification to help improving sustainability in farming it needs "a strong apparatus of technicians bringing support and bridging the divide between certifications and smallholder farmers."

To establish the link to the second constraint identified at the cooperative level, one must not forget that it is also a conscious decision of the cooperative management what topics/matters are important and worth dedicating much time to. From fieldwork it became clear that the cooperatives have a strong focus on optimizing productivity, which is a legitimate and appropriate goal for the administrators of a cooperative, as they work to improve farmers' yields and incomes.

Regarding the forth hypothesis, findings pointed out that producers do perceive some of the environmentally sustainable practices as fostered by certifications as ineffective or impractical. Results described how organic fertilizers/soil amendments were perceived as inefficient and the use of unprocessed coffee pulp as unacceptable. Partly, this might be because producers are not sufficiently informed or convinced about the benefits that accrue from organic farming practices which again points to capacity constraints of the cooperative.

The barriers to the use of coffee pulp/compost that I have reported from Tarrazú area, have been reported elsewhere too. A study from Nicaragua describes how conventional Fairtrade farmers consider the odor -producing coffee pulp, as waste and freely give it away to nearby organic farmers, who appreciate its fertilizing qualities (Valkila, 2009).

Lastly, it was confirmed that there are farmers' characteristics which impede environmental sustainability in coffee production as aimed for by certifications. I identified age to be a critical factor. As for the new generation of farmers, which is higher educated and invests more in agrochemicals, some structural changes in Costa Rica might explain this phenomenon. Because younger people in the study area are nowadays higher educated and have more possibilities to make a living away from coffee farming in bigger cities or abroad, the ones staying behind might also be the ones who want to make farming a lucrative business and thus invest more in agro-chemical inputs.

6.4. Generalizability

A review by the International Trade Centre (WTO/ UNCTAD[24]) found that generalizations in regard to impact of certifications are frequently based on very few or single cases (ITCa, 2011a). I do not claim generalizability of my findings. In fact, this study suggests that certification impacts strongly depend on local conditions. As depicted in this study, for the extent to which certifications contribute to environmental sustainability in coffee production the strategy, philosophy and capacity of a cooperative as well as farmers' perceptions and approaches to farming matter.

Cooperatives are no islands. As hinted in the logic model this study built onto (see 3.4) factors determining the success of such initiatives go far beyond the producer- and administrator-level investigated in this study. There are many external factors which determine the implementation and outcome of certification programs and these external factors are likely to vary largely from region to region, from country to country.

As pointed out in the results section, in the case investigated in this study the strengthening of activities happened in a surrounding where the environmental discourse had already progressed. This undoubtedly fostered the integration of certification requirements into the cooperatives' services. In other, more or less supportive, environments, the effect of certifications on trainings possibly would have been different. Indeed, combining my findings with findings from the Fairtrade literature suggests that the type and extent of service offered by the cooperatives, as results of certifications, depends on the broader regional background the cooperative operates in. In Mexico, for example, there is a large market for double-certified organic and Fairtrade coffee. Research found that trainings on organic practices were a common investment Fairtrade certified cooperatives made from Fairtrade funds. The point is, the cooperative might have made very different investments in a different environment, in which the transition to organic is not generally fostered.

A positive surrounding fostering the more sustainable farming practices might also be created by NGOs or other organizations (Raynolds et al., 2004). In Nicaragua, it has been reported that a coffee producer cooperative could only attain organic certification because of support from various NGOs assisting the transition to organic. These organizations provided some financial means, but also training. (Valkila, 2009). These are only a few examples of how external factors may be relevant.

[24] UNCTAD= United Nations Conference on Trade and Development

Even though commonly referred to as “standards” I therefore conclude that depending on the context, the impact of certification on farming practices is heavily influenced by local conditions. From what we know so far, it is not generalizable across different settings. This in turn legitimizes case studies like this, which take into consideration the local conditions in which certifications operate. Only this way, we can gain a better understanding of how certifications operate and what are the major constraints and possible points of venture for improvement.

7. Conclusion

This study has investigated how sustainable coffee certifications impact farming practices in two coffee cooperatives in Tarrazú region, Costa Rica. *From the farmers experience*, such certifications which address the group of farmers as a whole rather than the individual (Faitrade, C.A.F.E. Practices) have very little effects on farming practices. This is because the vast majority is not aware of their participation in the certification program. In contrast, certifications which are admittedly also managed by the cooperative, but instead of the whole group address the individual (Rainforest Alliance) have in the majority of cases caused farmers to make specific changes in farming practices. Amongst the specific changes due to individual certifications, the most commonly mentioned by farmers were the increase in vegetative barriers and the banning of certain types of agrochemicals.

In the case of the two cooperatives visited, despite not directly acknowledged by farmers, I conclude that group certifications *have* an impact on farming practices. Unlike most of the existing studies on certification impacts, this work has extended the investigations to *the cooperative level*. In the face of an already ongoing environmental discourse, certification requirements have been integrated into both cooperatives’ strategies and services offered to farmers. Specifically, certifications have altered the content of farmer trainings towards more environmental sustainability-related topics. As cooperatives constitute the most important sources of information to farmers, certifications reach out to the individual, and consequently to farming practices, through the cooperatives activities. It is thus concluded that in Tarrazú, certifications have contributed to the reduction of herbicides and the increased use of shade providing species in coffee farming.

As the aim of certifications, a more sustainable coffee production, is an aim which is also shared by other initiatives, precise certification effects could not be disentangled in the scope of this case study. But the strength of this research lies somewhere else. Because of the in-depth analysis at farm- as well as cooperative level, this study has described the mechanism by which certifications operate in a complex environment of other factors. As a consequence, some of the main limitations to a sustainable coffee production as fostered by certifications could be identified. On the farm level, these include an increasing pest pressure, the rise of a new generation of farmers which uses more inputs as well as farmers critics of some of the practices promoted by certifications. On the cooperative level, the main constraints to a more environmentally sustainable production are the limited capacities to disseminate information as well as the cooperatives’ aim to increase productivity.

Results of this case study suggest that in *general*, the practical implementation of theoretical certification “standards” crucially depends on the specific local environments in which certifications operate. It is concluded that besides a supportive surrounding, the cooperatives’ strategies and capacities are key to a successful “greening” of farming practices as aimed for by certifications.

8. Practical Implications

In order to make sure that certifications contribute to a more sustainable coffee production actions need to be taken from different sides. First of all, the focus of research needs to be shifted away from the plain focus on measuring environmental outcomes towards identifying points of venture for improvement. This can either be achieved by the conduction of independent studies (like this one) or, through public-private partnerships in which independent research institutions collaborate with certification agencies and/or NGOs for example. This fits with a relatively new approach of academic research which is termed action research. It may be defined as “a disciplined process of inquiry conducted by and for those taking the action.” And its goals to “assist the ‘actor’ in improving/or refining his or her actions.” (Sagor, 2000). Either way, possible local-as well as regional level constraints could be defined by such investigations.

This study suggests that for certifications to unfold their potential impacts, shortcomings in the availability of administrative staff need to be addressed. This could either be done by increasing the cooperatives’ own capacities or by collaborations with NGOs and other supportive organizations that assist farmers and cooperatives in putting environmental standards from theory into practice. Models in which some of the “extra money “paid for certified coffee is retained for investments in such capacity-strengthening activities are conceivable. Anyways, for investments to be done in this area it is important to develop appropriate public relation strategies, that foster the ongoing process of increasing consumer sensitivity.

9. References

Akiyama, T., & Varangis, P. N. (1990). The impact of the International Coffee Agreement on producing countries. *The World Bank Economic Review, 4*(2), 157-173.

Aranda, J., & Morales, C. (2002). Poverty alleviation through participation in fair trade coffee networks: The case of CEPCO, Oaxaca, Mexico. *Report prepared for Fair Trade Research Group, Colorado State University, Fort Collins, USA.*

Arnould, E. J., Plastina, A., & Ball, D. (2006). Market disintermediation and producer value capture: The case of fair trade coffee in Nicaragua, Peru and Guatemala. *Publication of the Marketing Department of the University of Nebraska*, *Lincoln, USA*

Auld, G. (2010). Assessing Certification as Governance: Effects and Broader Consequences for Coffee. *The Journal of Environment & Development, 19*(2), 215-241.

Avelino, J., Cristancho, M., Georgiou, S., Imbach, P., Aguilar, L., Bornemann, G., . . . Morales, C. (2015). The coffee rust crises in Colombia and Central America (2008–2013): impacts, plausible causes and proposed solutions. *Food Security, 7*(2), 303-321.

Babbar, L. I., & Zak, D. R. (1995). Nitrogen loss from coffee agroecosystems in Costa Rica: leaching and denitrification in the presence and absence of shade trees. *Journal of Environmental Quality, 24*(2), 227-233.

Babin, N. (2014). The Coffee Crisis, Fair Trade, and Agroecological Transformation: Impacts on Land Use Change in Costa Rica. *Agroecology and Sustainable Food Systems*. *39*(1), 99-129.

Bacon, C. (2005). Confronting the Coffee Crisis: Can Fair Trade, Organic, and Specialty Coffees Reduce Small-Scale Farmer Vulnerability in Northern Nicaragua? *World Development, 33*(3), 497-511.

Bacon, C. M., Ernesto Mendez, V., Gómez, M. E. F., Stuart, D., & Flores, S. R. D. (2008). Are sustainable coffee certifications enough to secure farmer livelihoods? The millenium development goals and Nicaragua's Fair Trade cooperatives. *Globalizations, 5*(2), 259-274.

Balbach, E. D. (1999). Using Case Studies to do Program Evaluation. *Published by the California Department of Health Services, USA.*

Barbosa de Lima, A., Keppe, A. N., Maule, F., Sparovek, G., Alves, M. C., & Maule, R. (2009). Does certification make a difference? Impact assessment study on FSC/SAN certification in Brazil. *Published by Imaflora,Sao Paulo, Brazil.*

Barham, B. L., & Weber, J. G. (2012). The Economic Sustainability of Certified Coffee: Recent Evidence from Mexico and Peru. *World Development, 40*(6), 1269-1279.

Bates, R. H. (1998). Open-economy Politics: The Political Economy of the World Coffee Trade. *Princeton University Press.USA*

Beer, J., Muschler, R., Kass, D., & Somarriba, E. (1997). Shade management in coffee and cacao plantations. *Agroforestry Systems, 38*(1-3), 139-164.

Bernstein, S., & Cashore, B. (2007). Can non-state global governance be legitimate? An analytical framework. *Regulation & Governance, 1*(4), 347-371.

Blackman, A. N., Naranjo M. A. (2012). Does eco-certification have environmental benefits? Organic coffee in Costa Rica. *Ecological Economics, 83*, 58-66.

Blackman, A. Rivera, J. (2010). The Evidence Base for Environmental and Socioeconomic Impacts of "Sustainable" Certification. In R. f. t. Future (Ed.), *RFF DP 10-17*. Washington: Resources for the Future.

Castro-Tanzi, S., Dietsch, T., Urena, N., Vindas, L., & Chandler, M. (2012). Analysis of management and site factors to improve the sustainability of smallholder coffee production in Tarrazú, Costa Rica. *Agriculture, Ecosystems & Environment, 155*(0), 172-181.

Castro, Á. J. (2013). El café en Costa Rica - Gran modelador del costarricense. *Published by University of Costa Rica. San José, Costa Rica. [In Spanish]*

Chen, M. A., Jhabvala, R., Kanbur, R., & Richards, C. (2006). Membership Based Organizations of the Poor: Concepts, Experience and Policy. *Working Paper published by the Department of Applied Economics and Management, Cornell University, New York, USA*

Constantino, L. P., LG. (unknown). Soil arthropod diversity, microbial activity and physical-chemical characteristics in certified and noncertified farms in Colombia. *Retrieved from a sysposis study. Available online: http://www.rainforest-alliance.org/sites/default/files/publication/pdf/cenicafe_singles_0.pdf*

Coope Tarrazú (2014a). Internal List of Farmer Trainings 2014. (unpublished)

Coope Tarrazú (2014b). Powerpoint Presentation (unpublished).

Coope Tarrazú. (2015). CoopeTarrazú Official Homepage - Section COOPETARRAZÚ EN EL CAMPO. *Retrieved from http://cafeTarrazú.com/wordpress/campo/. on 28/05/2015 [in Spanish]*

Creswell, J. (2011). Controversies in Mixed Methods Research. *In N. K. L. Denzin, Yvonna S. (Ed.), The SAGE Handbook of Qualitative Research (Vol. 4, pp. 784). SAGE Publications Inc, USA*

Elder, S. D., Zerriffi, H., & Le Billon, P. (2013). Is Fairtrade certification greening agricultural practices? An analysis of Fairtrade environmental standards in Rwanda. *Journal of Rural Studies, 32*, 264-274.

Fairtrade Itl. (2011a). Fairtrade Standards for Small Producer Organizations Version 01.05.2011_v1.2. *Bonn, GER*. *Available online: http://www.fairtrade.net/fileadmin/user_upload/content/2009/standards/documents/2012-07-11_SPO_EN.pdf. Retrived in July 2015.*

Fairtrade Itl. (2011b). History of Fairtrade. *Section on Homepage. Retrieved from http://www.fairtrade.net/history-of-fairtrade.html on 20/06/2015*.

Fernández, C., & Muschler, R. G. (1999). Aspectos de la sostenibilidad de los sistemas de cultivo de café en América Central. *Desafíos de la Caficultura en Centroamérica*, 69-96.

Galindo, L., Constantino, L., Benavides, P., Montoya, E., & Rodriguez, N. (2014). Evaluación de macroinvertebrados acuáticos y calidad de agua en quebradas de fincas cafeteras de Cundinamarca y Santander Colombia. *Published in Hughell (2013).*

Garson, G. D. (2012). Measures of Association (Statistical Associates "Blue Book" Series Book 8). *Asheboro, USA.*

Garza, V. P., & Trejo, E. C. (2002). Poverty alleviation through participation in fair trade coffee networks: The case of union Majomut, Chiapas, Mexico. *Fair Trade Research Group, Colorado State University, USA*

Giovannucci, D., Potts, J., Killian, B., Wunderlich, C., Soto, G., Schuller, S., . . . Vagneron, I. (2008). Seeking sustainability: COSA preliminary analysis of sustainability initiatives in the coffee sector. *Committee on Sustainability Assessment*.

Government of Costa Rica. (2013). Dectreto emergencia fitosanitaria nacional por epifitia y daño severo causado por la roya (hemileia vastatrix) en cultivo del café. Government Costa Rica, *[in Spanish]* .

Hatanaka, M., Bain, C., & Busch, L. (2005). Third-party certification in the global agrifood system. *Food Policy, 30*(3), 354-369.

Hughell, D. a. N., D. (2013). The Impact of Rainforest Alliance Certification on Coffee Farms in Columbia . Evaluating the Results of our Work. *Avilable online: http://www.rainforest-alliance.org/sites/default/files/publication/pdf/cenicafe_singles_0.pdf*

i3 (2012). Third i3 Impact Evaluation Glossary*. International Initiative for Impact Evaluation*. *Available online: http://www.3ieimpact.org/media/filer_public/2012/07/11/impact_evaluation_glossary_-_july_2012_3.pdf, as Retrieved in June 2015.*

ICAFE (2012). Informe Actividad Cafetalera. Instituto del Café de Costa Rica, available online: *http://www.icafe.go.*cr*/icafe/cedo/documentos_textocompleto/Icafetalero/4077.pdf [In Spanish]*

ICAFE (2013). Informe Actividad Cafetalera. *Instituto del Café de Costa Rica**, available online: http://www.stc-coffee.com/wp-content/uploads/2014/01/Informe-Actividad-Cafetalera-2013.pdf. [In Spanish]*

ICO, (2015). Statistics on total coffee production by country. *Retrieved on 16/06/2015, from http://www.ico.org/historical/1990%20onwards/PDF/1a-total-production.pdf*

INEC. (2007). Censo Cafetalero ICAFE y INEC. *San Jose, Costa Rica.*

ITC (2011a). THE IMPACTS OF PRIVATE STANDARDS ON PRODUCERS IN DEVELOPING COUNTRIES. *published by International Trade Center.Geneva, Switzerland:*

ITC (2011b). Trends in Trade of Certified Coffees. , *published by International Trade Center. Geneva, Switzerland.*

Jaffee, D. (2008). Better, but not great: The social and environmental benefits and limitations of Fair Trade for indigenous coffee producers in Oaxaca, Mexico. *Wageningen Academic Publishers, Wageningen, NL*

Jha, S., Bacon, C. M., Philpott, S. M., Rice, R. A., Méndez, V. E., & Läderach, P. (2011). A Review of Ecosystem Services, Farmer Livelihoods, and Value Chains in *Shade Coffee Agroecosystems. 1*, 141-208.

Kilian. (2004). Can the Private Sector be Competitive and Contribute to Development through Sustainable Agricultural Business? A Case Study of Coffee in Latin America. *International Food and Agribusiness Review, 7 (3)*. *21-45*

Kirkpatrick, P., & van Teijlingen, E. (2009). Lost in Translation: Reflecting on a Model to Reduce Translation and Interpretation Bias. *The Open Nursing Journal, 3*, 25-32.

Krupka, J. (2012). The Fair Trade Coffee Business Model's Affect on the Small Scale Producers through the Lens of the Triple Bottom Line. *Dissertation. Georgia State University, Georgia, USA*

Lewin, B., Giovannucci, D., & Varangis, P. (2004). Coffee markets: new paradigms in global supply and demand. *World Bank Agriculture and Rural Development Discussion Paper*(3).

Luetchford, P. (2007). Fair Trade and a Global Commodity: Coffee in Costa Rica. *Pluto Press, London UK:*

Lyngbaek, A., & Muschler, R. (2001). Productivity and profitability of multistrata organic versus conventional coffee farms in Costa Rica. *Agroforestry Systems, 53*(2), 205-213.

Lyon, S. (2007). Maya Coffee Farmers and Fair Trade: Assessing the Benefits and Limitations of Alternative Markets. *Culture & Agriculture, 29*(2), 100-112.

Mendez, V. E. (2002). Fair Trade networks in two coffee cooperatives of Western El Salvador: An analysis of insertion through a second level organization. *Case Study Prepared for the Project on "Poverty Alleviation Through Participation in Fair Trade Networks". Colorado State University, Fort Collins, USA*

Méndez, V. E., Shapiro, E. N., & Gilbert, G. S. (2009). Cooperative management and its effects on shade tree diversity, soil properties and ecosystem services of coffee plantations in western El Salvador. *Agroforestry Systems, 76*(1), 111-126.

Morra, L. G., & Friedlander, A. C. (1999). Case study evaluations. *World Bank, Washington, DC., USA*

Muradian, R., & Pelupessy, W. (2005). Governing the coffee chain: The role of voluntary regulatory Systems. *World Development, 33*(12), 2029-2044.

Murray, D. R., L. T. and Taylor, P.L.. (2003*).* One cup at a time: Poverty Alleviation and Fair Trade in Latin America. *Published by the Fair Trade Research Group, Colorado State University, USA*

NIFA. (2015). Integrated Programs' Logic Model Planning Process. *Developed by the National Institute of Food and Agriculture,USDA (United States Department of Agriculture).. Available online: http://nifa.usda.gov/resource/integrated-programs-logic-model-planning-process*

OECD.(2006) Outline of principles of impact evaluation - PART I Key Concepts: OECD. *As retrieved in June 2015. Available online: http://www.oecd.org/dac/evaluation/dcdndep/37671602.pdf*

Oram, J., & Winnet, A. (2002). Fair Trade is a worthy idea but flawed in practice. *Small Enterprise Development, 13*(3), 4-7.

Osorio, N. (2005). Lessons from the world coffee crisis: A serious problem for sustainable development. *International Coffee Organization, London. Available online: http://www. ico. org/electdocs/archives/cy2003-04/English/ed/ed1922. Pdf. Retrieved in May 2015.*

Ottman, J. (2011). The New Rules of Green Marketing: Strategies, Tools, and Inspiration for Sustainable Branding: *Berrett-Koehler Publishers, San Francisco, USA*

Paschall, M. (2013). The Role of Third Party Certification in Improving Small Farmer Livelihoods*. Disseration.* University of St. Gallen, *CHE*

Pearson, R. W. et al. (1992). Personal Recalls and the Limits of Retrospective Questions in Surveys. *In J. M. Tanur (Ed.),* Questions about questions: Inquiries into the cognitive bases of surveys: Russell . *Sage Foundation., New York, USA*

Philpott, S. M., Bichier, P., Rice, R., & Greenberg, R. (2007). Field-Testing Ecological and Economic Benefits of Coffee Certification Programs. *Conservation Biology, 21*(4), 975-985.

Ponte, S. (2002). The latte revolution? Regulation, markets and consumption in the global coffee chain. *World Development, 30*(7), 1099-1122.

Quispe Guanca, J. L. (2007). Caracterización del impacto ambiental y productivo de las diferentes normas de certificación de café en Costa Rica. *Master Thesis.(Magister Scientiae en Agricultura Ecológica), CATIE, Turrialba, Costa Rica. [In Spanish]*

Rainforest Alliance. (2015). Homepage - About Us. *http://www.rainforest-alliance.org/about,retrieved in June 2015.*

Raynolds, L. T. (2009). Mainstreaming fair trade coffee: from partnership to traceability. *World Development, 37*(6), 1083-1093.

Raynolds, L. T., Murray, D., & Heller, A. (2007). Regulating sustainability in the coffee sector: A comparative analysis of third-party environmental and social certification initiatives. *Agriculture and Human Values, 24*(2), 147-163.

Raynolds, L. T., Murray, D., & Leigh Taylor, P. (2004). Fair trade coffee: building producer capacity via global networks. *Journal of International Development, 16*(8), 1109-1121.

Renard, M.-C. (2003). Fair trade: quality, market and conventions. *Journal of Rural Studies, 19*(1), 87-96.

Rice, R. (1991). Observaciones sobre la transición en el sector cafetalero en Centroamérica. *Agroecologia Neotropical 2(1): 1-6[In Spanish]*

Rice, R. (2003). Coffee Production in a Time of Crisis: Social and Environmental Connections. *SAIS Review, 23*(1), 221-245.

Rice, R. A., & Ward, J. R. (1996). Coffee, conservation, and commerce in the Western Hemisphere. *Washington, DC: The Smithsonian Migratory Bird Center and the Natural Resources Defense Council*.

Ronchi, L. (2002). The Impact of Fair trade on Producers and Their Organizations: A Case Study with COOCAFE in Costa Rica. Published by *the Poverty Research Unit (PRUS) of University of Sussex, USA*

Rueda, X., & Lambin, E. F. (2013). Responding to Globalization: Impacts of Certification on Colombian Small-Scale Coffee Growers. *Ecology and Society, 18*(3). doi: 10.5751/es-05595-180321

Sagor, R. (2000). Guiding school improvement with action research: *published by the Association for Supervision and Curriculum Development*.

Salazar, J. A. V. (2008). la actividad cafetalera en los santos: diagnostico para un anÁlisis de los medios de vida en la agrocadena. *Centro Internacional de Politica Economica*. *Available online as retrieved in July 2015: http://unpan1.un.org/intradoc/groups/public/documents/icap/unpan045951.pdf. [In Spanish]*

Samper, M. (2010). Costa Rica's response to the coffee crisis. *Latin American Perspectives, 37*(2), 72-92.

SAN (2010). Rainforest Alliance Standards V3, *Sustainable Agriculture Network.. http://www.san.ag/biblioteca/docs/SAN-S-1-1.2_Sustainable_Agriculture_Standard.pdf:*

Schieber, E., & Zentmyer, G. (1984). Distribution and spread of coffee rust in Latin America*. Paper presented at the Symposium on Coffee Rust in the Americas, St. Paul, Minnesota, USA.*

Serna, C. (2010). Identification of the economic and social advantages and disadvantages of the adoption of the Rainforest Alliance coffee certification standard in Colombia. *As derived from a synopsis: see Hughell (2013)*

Sibelet, N. M., M.; Arragon, P.; Luye M. (2013). Qualitative survey methods applied to natural resource management. *Online learning modules. Available at: http://entretiens.iamm.fr/.*

Sick , D. (2008). Coffee, Farming Families, and Fair Trade in Costa Rica: New Markets, Same Old Problems? *Latin American Research Review, 43*(3), 193-208.

Siddiqui, K. (2013). Heuristics for sample size determination in multivariate statistical techniques. *World Applied Sciences Journal, 27*(2), 285-287.

Snider, A. (2013a). *Case Study Report Llano Bonito*. Fieldwork Report (unpublished).

Snider, A. (2013b). *Coope Tarrazú Data Sheet* (unpublished)

Snider, A. (2013c). *Llano Bonito Data Sheet* (unbublished)

Starbucks, (2013). STARBUCKS GLOBAL RESPONSIBILITY REPORT Goals and Progress.

Starbucks Coffee Company. (2014). C.A.F.E. Practices Smallholder Scorecard Version 3.3: Available online*: http://www.scsglobalservices.com/files/cafe_scr_smallholderv3.3_111814.pdf*

Swanborn, P. (2010). *Case Study Research: What, Why and How?* : *SAGE Publications, New York, USA*

Tabachnik, B. G. Fidell, L. S. (2013). Using Multivariate Statistics (6th edition). *Pearson Education Ltd. Harlow, UK:*

Trimarchi, E. (2014). The environmental, social and economic impact of different certification programmes of coffee in Santander, Colombia. *Master Thesis. Utrecht University, NL*

Utting-Chamorro, K. (2005). Does fair trade make a difference? The case of small coffee producers in Nicaragua. *Development in Practice, 15*(3-4), 584-599.

UW-Extension,. (2014). Logic Model, University of Westcounsin., deived from *http://www.uwex.edu/ces/pdande/evaluation/evallogicmodel.html*

Valkila, J. (2009). Fair Trade organic coffee production in Nicaragua — Sustainable development or a poverty trap? *Ecological Economics, 68*(12), 3018-3025.

Valkila, J., & Nygren, A. (2010). Impacts of Fair Trade certification on coffee farmers, cooperatives, and laborers in Nicaragua. *Agriculture and Human Values, 27*(3), 321-333.

Varangis, P. N. S., P.; Giovannucci, D; Lewin, B. . (2003). Dealing with the coffee crisis in Central America: Impacts and strategies *(Vol. 2993): World Bank Publications*.

Willey, R. (1975). The use of shade in coffee, cocoa and tea*. Paper presented at the Horticultural Abstracts.*

Wollni, M. Z., M. (2007). Do farmers benefit from participating in specialty markets and cooperatives? The case of coffee marketing in Costa Rica. *Agricultural Economics, 37*(2-3), 243-248.

World Bank (2003). Reaching the rural poor - a renewed strategy for rural development - a summary Retrieved *from http://documents.worldbank.org/curated/en/2003/08/5271834/reaching-rural-poor-renewed-strategy-rural-development-summary* in *June 2015*

Wunsch, G. (2007). Article 4: Confounding and Control *Demographic Research (Vol. 16, pp. 97-120). Rostock, GER: Max Planck Institute.*

Yin, R. K. (2009). *Case Study Research: Design and Methods*: *SAGE Publications, New York, USA*

10. Appendices

Appendix I: Final Questionnaire (English Translation)

Note: The Questionnaire also served the collection of data not used in this study, e.g. data on the Use of record keeping and occupational safety measures. These data may be used in Anna Snider's PhD project.

Block A: Farming Background, Cooperative Membership, Basics

Question No	Question	Original Purpose
1 Open	Where have you learned how to manage your coffee field?	Influence of Farming Tradition Background as compared to other factors
1 A Follow up	When (how many years ago) have you started working in a cafetal?	
1 B Follow up	Who was the owner of the coffee field where you started working with coffee?	
1 C Follow up	Since how many years have you been the person who takes the management decisions?	
1 D Follow up	Who took the management decisions about your coffee field before? ➔ To clarify whether its the same piece of land where he/she started working	
2 Open	When you compare how the coffee field where you started was managed with how your coffee field nowadays is managed – what are the most striking differences?	Influence of Farming Tradition Background Influence of external factors over time
3 Open	Nowadays, what are your sources of information concerning advances in farming techniques (p.e. control of pests, weeds, fertlization etc..)?	Influence of institutions, the cooperative etc.
4 Closed	Coffee Varieties	Influence of agroecological conditions
5 Closed	Size of Coffee Field	Basics
6 Closed	A Membership at producer organizations B Membership Duration	Influence of the cooperative
7 Open	Reasons/Motivations to join cooperative(s)	Case Description Data for Anna
8 Open	Advantages of being a member at the different cooperative(s) today	Case Description Data for Anna
9 Open	What type of services or support have you received from each cooperative so far?	Influence of the cooperative Data for Anna
10 Closed	Age	Basics
11 Closed	Years of education	Basics

Block B: Farming Background, Cooperative Membership, Basics

Question No	Question	Purpose
V1 Closed	During the past year, how many visits have you received from the agronomist(s) of your cooperative (CoopeLB or CT or both, repectively)?	Influence of the cooperative
V2 Follow up	For each: Was this a normal year (do you normally receive [...] visits/year) ?	Influence of the cooperative
V3 Follow up	If not, how many visits do you usually receive?	Influence of the cooperative
V4 Follow up	If less than 1, how many visits have you received in total, since you are member?	Influence of the cooperative
Ch1	I have heard that the cooperative(s) offer technical talks (charlas). During the past year, how many times have you participated?	Influence of the cooperative
Ch2	For each: Was this a normal year (do you normally receive [...] visits/year) ?	Influence of the cooperative
Ch3	If not, how many technical talks do you usually visit?	Influence of the cooperative
Ch4	If less than 1, how many technical talks have you visited since you are member?	Influence of the cooperative
I Open	Since you grow coffee, in what talks/events that were organized by other institutions or companies have you participated (for example ICAFE, INA, MAG, CATIE, Starbucks..)? *Please specify.*	Influence of external institutions (private or public)
I A-C Follow up	A) What Insitution? B) How many? C) What topic?	Influence of external institutions (private or public)
I D Follow up Open	*If topic had to do sth. With "green practices":* How could you transfer what you have learned?	Influence of external institutions (private or public)
E1 Open	In what events/projects have you participated, where environmental topics were discussed?	Influence of external institutions (private or public)
E1 A-C Follow up	A) What Insitution? B) How many? C) What topic?	Influence of external institutions (private or public)
E1 D Follow up Open	How could you transfer what you have learned?	Influence of external institutions (private or public)
E2 Open	At your school, during classes, how were environmental topics touched (p.e. climate, pollution, erosion, biodiversity...)?	Influence of public education (schools)
Cert1	Are you familiar with the concept of certification? [ ] Y [ ] N	Direct Influence of Certification
Cert1 A-C	If no, Have you heard the expressions...? A) Comercio Justo, Fairtade, FLO [ ] Y [ ] N B) C.A.F.É. Practices or Starbucks [ ] Y [ ] N C) Rainforest Alliance	Direct Influence of Certification
Cert1 D	If yes (at least on of Cert1, Cert1A-C), are you certified / do you hold a certification? [ ] Y [ ] N	Direct Influence of Certification
Cert2 A-B	If certified A) what certificate, B) since when?	Direct Influence of Certification
Cert2 C Open	If certified, what changes have you made on your farm due to certifications?	Direct Influence of Certification

Block C: Agrochemical Use, Conservation Practices, Record keeping, Occupational Safety

Block C: Fungicides

Question No	Question	Purpose
P1 Open	Since you have started taking the managment decisions, what changes have you made with regards to the use of **fungicides**?	Changes in Farming Practices
P2 A-B Closed	A What type(s) of pest(s) have you observed in your coffee field? B Since when	Influence of agroecological conditions
P3 Open	Besides using fingicides, what other measure do you use to control pests?	Farming Practices
P3 A- B	If yes, A) what and B) since when?	Changes in Farming Practices
P4 Closed	Since when have you been using fungicides on your coffee farm (since you are the one to take decisions)?	Changes in Farming Practices
P4 A-B	If not since the beginning, A) when and B) why have you started to use them?	Changes in Farming Practices Drivers for Changes in FPs
P5 Closed	How many times have you sprayed fungicides last year (*el ano pasado*)?	Farming Practices
P6	Have you always (since you started using pesticides) applied with this frequency?	Changes in Farming Practices
P6 A-C	If not, A) when, B) how and C) why have you changed the frequency?	Drivers for Changes in FPs
P7 A-B Follow up	*If no "clear" change can be described, ask for tendency.* A) As a general tendency, since you started taking the decisions, have you [ ] increased **or** [ ] reduced the number of applications **or** aren't you able to note any tendency because the frquency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
P8 A-B	A) As a general tendency, since you started taking the decisions, have you [ ] increased or [ ] reduced the dose or aren't you able to note any tendency because the frquency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
P9 Open	Do you know natural ways to control for pests? If so, do you use them?	Farming Practices
P10	Do you think that, in the past, you would have used more fungicides if the product prices had been lower?	Influence of Prices for Agrochemicals

Block C: Herbicides

Question No	Question	Purpose
H1 Open	Since you have started taking the management decisions, what changes have you done with regards to the use of **herbicides**?	Changes in Farming Practices
H2 Closed	Since when have you been using herbicides on your coffee farm (since you are the one to take decisions)?	Changes in Farming Practices
H2 A-B	If not since the beginning, A) when and B) why have you started to use them?	Changes in Farming Practices Drivers for Changes in FPs
H3	On average, how many times have you applied herbicides during the past 3 years?	Farming Practices
H4	Have you always (since you started using herbicides) applied with this frequency?	Changes in Farming Practices
H4 A-C	If not, A) when, B) how and C) why have you changed the frequency?	Drivers for Changes in FPs
H5 A-B	*If no "clear" change can be described, ask for tendency.* A) As a general tendency, since you started taking the decisions, have you [ ] increased **or** [ ] reduced the number of applications **or** aren't you able to note any tendency because the frquency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
H6 A-B	A) As a general tendency, since you started taking the decisions, have you [ ] increased or [ ] reduced the dose or aren't you able to note any tendency because the frquency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
H7	Do you think that, in the past, you would have used more herbicides if the product prices had been lower?	Influence of Prices for Agrochemicals

Block C: Fertilizers

Question No	Question	Purpose
F1 Open	Since you have started taking the management decisions, what changes have you made with regards to the use of **fertilizer**?	Changes in Farming Practices
F2	Since when have you been using chemical fertilizers on your coffee farm (since you are the one to take decisions)?	Changes in Farming Practices
F2 A-B	If not since the beginning, A) when and B) why have you started to use them?	Changes in Farming Practices Drivers for Changes in FPs

F3	On average, how many times have you applied chemical fertilizer during the past 3 years?	Farming Practices
F4	Have you always (since you started using herbicides) applied with this frequency?	Changes in Farming Practices
F4 A-C	If not, A) when, B) how and C) why have you changed the frequency?	Drivers for Changes in FPs
F5 A-B	*If no "clear" change can be described, ask for tendency.* A) As a general tendency, since you started taking the decisions, have you [ ] increased **or** [ ] reduced the number of applications **or** aren't you able to note any tendency because the freuency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
F6 A-B	A) As a general tendency, since you started taking the decisions, have you [ ] increased or [ ] reduced the dose or aren't you able to note any tendency because the frquency of applications has varied a lot from year to year? B) Reason for increase / reduction / variability: _____	Changes in Farming Practices Drivers for Changes in FPs
F7	Have you noticed any changes in the soil fertility on your coffee field? *(explain: the ability of the soil to provide enough nutrients for a good harvest)*	Influence of agroecological conditions
F8	Do you think that, in the past, you would have used more chemical fertilizer if the product prices had been lower?	Influence of Prices for Agrochemicals
F9 Open	Do you use any kind of organic/green/natural fertilizer (p.e. animal manure, compost)	Farming Practices
F10	Do you use.. The compost / coffee pulp from the cooperative(s)?	Farming Practices
F10 A-B Follow up	If not, why not? If yes, what for (Coffee, horticulture)?	Farming Practices

Block C: Shade Trees

Question No	Question	Purpose
T1 Open	Since you have started taking the management decisions, what changes have you made with regards to trees on your coffee farm?	Changes in Farming Practices
T2	Nowadays, what types of trees do you have on your coffee field?	Farming Practices
T3	¿Have you always had each species?	Changes in Farming Practices
T3 A-B Follow-up	If not, A) when and B) for what reasons have you introduced [...] [the species at hand]?	Changes in Farming Practices Drivers for Changes in FPs
T4	How have you changed the number of trees, or the quantity, since you have started taking the management decisions on your farm?	Changes in Farming Practices

T4 A-C Follow-up	If something has changed.. A) how [increased/decreased, what species], B) when and C) why have you changed the number of trees?	Changes in Farming Practices Drivers for Changes in FPs

Block C: Erosion Control

Question No	Question	Purpose
E1	Do you have (have you observed) problems with erosion on your fields?	Influence of agroecological conditions
E2 Open	What do you do to prevent erosion (What measures do you have) ?	Farming Practices
E3 Follow up	*If participant doesn't reply:* On your cafetal, do you have... [ ] terraces [ ] vegetation barriers [ ] water channels	Farming Practices
E3	For each: Since when have you been using [...] ?	Changes in Farming Practices
E3 A-B Follow-up	If not since the beginning, A) when and B) why have you started to use [...] ?	Changes in Farming Practices Drivers for Changes in FPs

Block C: Agrochemicals

Question No	Question	Origincal Purpose
X1 Open	Where do you normally buy your agrochemicals?	Influence of cooperative vs. Private traders
X2	In the past, has the case occured that the cooperative stopped selling a certain chemical product which you had been using before?	Influence of cooperative vs. law
X2 A-C Follow-up	If so, A) what product was it, B) when did they stop selling it and B) why do you think they stopped selling it?	Influence of cooperative vs. law

Block C: Other certification standards

Question No	Question	Purpose
PPE1 Open	When you apply agrochemicals, what types of protective equipment do you use? *Follow up: Do you use a mask / gloves?*	Farming Practices
PPE2	Since when have you been using this set of protective equipment ?	Changes in Farming Practices
PPE2 A-B Follow up	If not since the beginning, A) when and B) why have you started using it [or a certain type of equipment respectively]?	Changes in Farming Practices Drivers for Changes in FPs
Doc1	Do you use a book or something of written format, where you note what you did with regard to the management (p.e. number of applications, dose etc..)?	Farming Practices
Doc2	Since when have you been using a book?	Changes in Farming Practices

Doc2 A-B Follow up	If not since the beginning, A) when have you started using it and B) What was your reason/motivation to start using it?	Changes in Farming Practices Drivers for Changes in FPs
Bod1	Do you have a storage unit for you agrochemicals?	Farming Practices
Bod2	Since when have you had one?	Changes in Farming Practices
Bod2 A-B Follow up	If not since you take the decisions, A) when have you installed one and B) What was your reason/motivation to start using it?	Changes in Farming Practices Drivers for Changes in FPs

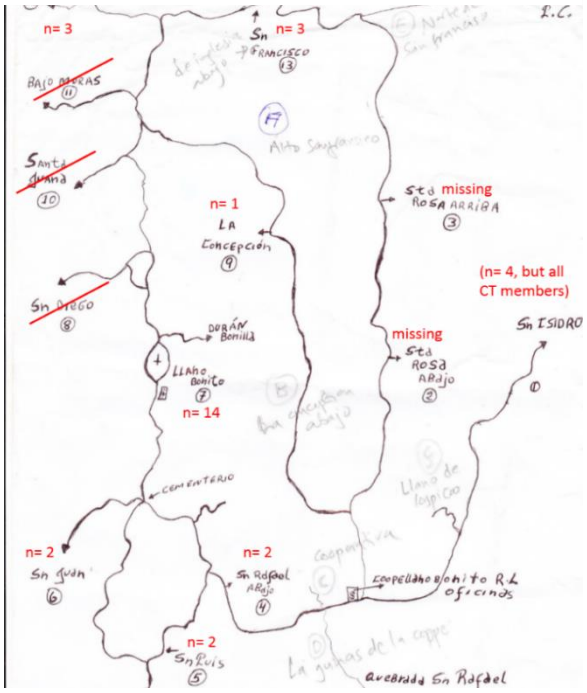
Appendix II: Sampling Distribution on the Map

Sampling at Llano Bonito Area

According to the agronomist at Llano Bonito, LB members are spread out over 10 communities (see Map 1). Of the 10 "valid" communities on the map, where we expected Llano Bonito members, some were very hard to reach. Because of limited resources (no public transport to these areas) I could not visit all of the 10 communities. Yet I managed to visit 8.

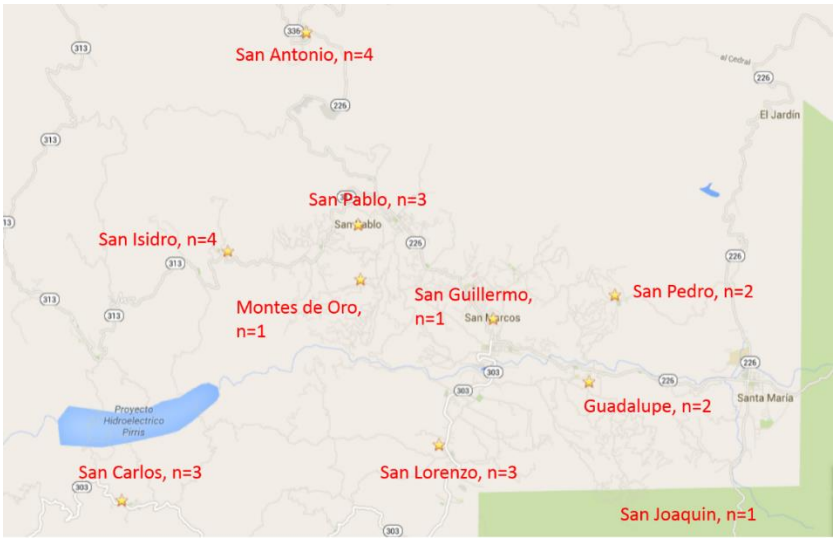
It turned out that none of the 4interviewees I talked to at San Isidro community, a place which was pointed out by the agronomist at LB as being part of Coope LB's area (see map),was a member at CoopeLB. Instead, all of them were members at CoopeTarrazú.

Map: Distribution of Interwiewees at Llano Bonito Area (n=27). Crossed out communities were not mentioned by the agronomist as places where members are located, at the time fieldwork was conducted.



Note: Map derived and updated from an old map of the area, drawn by the agronomist (2012) . Source: Sanjeeb Bhattarai, Student with CATIE.

Sampling at Coope Tarrazú Area



Map: Distribution of Interwiewees at Coope Tarrazú Area " (n=24). Map derived from GoogleMaps.

According to the field manager at Coope Tarrazú, members are mainly located in three major districts: San Marcos, San Pablo and San Carlos. Each district in turn consist of different communities. While doing research it was found later that there is also other, smaller communities outside these three main districts where members could be found. When possible, but mainly depending on poor transport opportunities, these rather distant communities were included into the sample. In total, 10 communities were visited. Geographically, they were quite evenly distributed throughout Coope Tarrazú area.

Appendix III: Fieldwork Time Distribution

Week	Activities
1	Meeting Anna at CATIE, organizational tasks (registration etc.), Literature review at CATIE library. Meeting Isabel Gutierrez (works with coffee certifications at CATIE), presentation of my project. Getting settled in Llano Bonito, getting to know the village and its people. Meeting of agronomist and manager at Llano Bonito, introduction to the project. 1st Interview with agronomist at LB. Visit at cooperative offices and the roasting house. Participation in women's group meeting at LB. Visit of Coope Tarrazú main offices. Visit at CoopeTarrazú Museum, San Marcos (no contact with staff yet, waiting for appointment).
2	Visa run to Nicaragua (I only got 30 days when entering Costa Rica). Participation in talk held at Llano Bonito. Topic: plant nutrition. Guest-speech from representative from agrochemical enterprise. Pilot interviews (2), Design of Questionnaire. Visit of diversified producer who has his own *microbeneficio*. Preparing Interview with agronomist at LB.
3	2nd Interview with agronomist at LB (evolution of farming practices). Re-adjustments of Questionnaire after realizing farmers don't know about certification. Key person Interview (young farmer). Conduction of Farmer Interviews at LB.
4	Workshop with Nicole Sibelet, re-defining research Questions. Re-adjustments of Questionnaire. Conduction of Farmer Interviews at LB area.
5	Conduction of Farmer Interviews at LB area.
6	Meeting with contact person (Sales Representative) at CT. Outcome: New appointment with another contact person (Fied manager). First Farmer Interviews in CT area. Participation in geneal meeting (all members invited) at LB.
7	3rd Interview with agronomist at LB (Topic: trainings offered, certification audits). Interview with Field Manager at CT + Discussion about Data collection procedure. Conduction of Farmer Interviews at LB area. Accompanying research assistant at CATIE at his work in LB area.
8	Analysis of first results from farmer Interviews at LB. Preperation of presentation and conduction of Feedback session at LB. Workshop with Nicole Sibelet. Farm visits with agronomist at CT.
9	Farm visits with agronomist of CT. Re-Planning of Fieldwork at CT. Farmer Interviews in CT area independently from agronomist. Visit of big landholder's farm in CT area.
10	Farmer Interviews in CT area. Key-Person Interview with Wage Labourer in Tarrazú region.
11	Farmer Interviews in CT area, Farmer Interviews in LB area. Farmer Interviews in CT area, LB
12	Final goodbye at the cooperative and village LB.

Appendix IV: Original Study Proposal as accepted by Supervisors

PRELIMINARY

The Influence of Certification on Environmental and Social Practices in Coffee Production:

A comparative case study of two coffee cooperatives in Tarrazú, Costa Rica

Background: Coffee Certifications in Costa Rica

Consumer demand for coffee which has been produced under environmentally sustainable and socially responsible conditions has strongly increased during the past decades. Today, various labels for 'ethical coffee production' exist. Despite having different requirements for production, most of these certifications have in common that they contain standards both addressing environmental and social concerns related to coffee production (Raynolds 2007).

Consistent with global market trends, in Costa Rica coffee certification has become widespread amongst coffee producers. Since the first coffee cooperative has been certified in 1989 (Fairtrade) many others have followed (Luetchford 2007, Ronchi 2002). Nowadays, coffee certification is a popular strategy amongst coffee cooperatives in the country; according to a recently conducted census (Snider 2013), most of the cooperatives hold at least one, but often some of the following certificates: Fairtrade International/USA, organic certification, UTZ, Rainforest Alliance, 4C, CAFÉ Practices (Starbucks) and AAA (Nespresso). Except of organic certification, which only considers environmental issues of production, all of the ones mentioned above contain regulations on both environmental and social practices related to production. It has recently been suggested that studies investigating the influence of certifications mainly focus on economic issues rather than environmental and social issues (Elder 2012, Elder2013). **Thus it yet needs to be investigated how certification has affected environmental and social practices in Costa Rican coffee production.**

Aside from certification however, there are other factors influencing environmental and social practices in coffee production. When exploring the influence of certification on such practices, it is therefore necessary to also take into consideration other factors influencing producers' decisions to change practices. For example have coffee production practices in Costa Rica also been influenced by changes in Costa Rican law, coffee market prices (Luetchford 2007) and the provision of incentives and farmer trainings by public and private institutions (Miranda 2003). Thus, in order to answer the question as to how certification has affected practices, it first needs to be clarified **to what extent decisions of coffee producers to change environmental and social practices have been influenced by certification schemes as compared to other drivers.**

Objective(s)

1. To investigate the relation between certification, other external factors and environmental and social practices in coffee production.
2. To explore to what extent coffee producers perceive certification as compared to other drivers to have influenced their decisions to change practices.

PRELIMINARY

Concepts and Definitions

- Environmental Practices in Coffee Production
  We distinguish between
  environmental practices ***at the farm level*** (farming practices) and
  environmental practices ***at the cooperative level*** (coffee processing + environmental services offered by the cooperative).

  Examples for environmental practices ***at the farm level*** are
  - Pesticide/herbicide/fertilizer use (levels and specification of "agrochemicals" applied)
  - Practices influencing soil fertility (erosive and protective measures)
  - Practices influencing water quality (Water pollution and conservation measures)
  - Biodiversity on farms (species diversity, copping system etc.)
  - Practices for re-cycling and re-using (i.e. organic matter incorporation)

  Examples for environmental practices ***at the cooperative level*** are
  - Environmental technology used collectively by the cooperative (i.e. coffee processing)
  - Farmer training on environmental issues provided by the cooperative
  - Environmental programmes run by the cooperative
  - Environmental projects conducted in co-operation with third parties (i.e. NGOs)

- Social Practices in Coffee Production
  As it is the case for the environmental practices, we will consider social practices both
  at the farm level *(*social practices related to production) and
  at the cooperative level (collective social practice + social services offered by the cooperative).

  Examples for social practices ***at the farm level*** are
  - On-farm practices regarding occupational safety (i.e. wearing PPE, pesticide storage)
  - Wages paid to hired labour force (i.e. during coffee harvest)
  - Extent to which child labour is employed

  Examples for social practices ***at the cooperative level*** are
  - Agronomic services provided by the cooperative (technical assistance to farmers)
  - Loans made available to cooperative members (provision of credit etc)
  - Health services offered to cooperative/community members
  - Education/Training offered to farmers (other than environmental training, which is already considered when investigating environmental practices)
  - Improvements in infrastructure and facilities made by the cooperative

PRELIMINARY

Research Questions

Evolving from the Research Objectives 'To investigate the relation between certification, other external factors and environmental and social practices in coffee production' and 'To explore what drives farm- and cooperative-level decisions to change such practices, two main Research Questions are posed. Within each cooperative, both farmers and administrators will be interviewed (two units of analysis). From this it follows that both farmers as well as cooperative administrators will be asked for changes at farm and cooperative level (see section on Study Design).The following investigation will be applied to each of the two cooperatives separately, taking into consideration varying contexts, influences and starting points. In order to point out similarities of and discrepancies between both cooperatives, we will at a later stage compare the results of both cooperatives and put them into a broader, regional, sectoral and national context.

1) **How do changes in environmental and social practices at farm and cooperative level relate to changes in *certification and other external factors*?**

    a. What changes in environmental and social practices have occurred in the last 20 years ***at farm level***?
    b. What changes in environmental and social practices have occurred in the last 20 years ***at cooperative level***?
    c. When did these changes occur?
    d. What changes in external factors such as legislation, coffee prices, institutional cooperation, certification etc. have occurred within the last 20 years ?
    e. When did these changes occur?
    f. What is the relationship between changes in environmental and social practices and changes in legislation, coffee prices, institutional cooperation, certification etc.?

2) **What were the perceived drivers for changes in environmental and social practices at farm and cooperative level ?**

    a. Has certification influenced decisions to change environmental and social practices *at farm and cooperative level*?
    b. Has legislation influenced decisions to change environmental and social practices *at farm and cooperative level*?
    c. Have coffee prices influenced decisions to change environmental and social practices *at farm and cooperative level*?
    d. Have public and/or private institutions influenced decisions to change environmental and social practices *at farm and cooperative level*?
    e. Have other factors influenced decisions to change environmental and social practices *at farm and cooperative level (such as informal networks, awareness of decreasing soil fertility etc.)*?

PRELIMINARY

Description of Selected Cases: Coope Llano Bonito and Coope Tarrazú

In order to investigate the influence of certification and other external factors on environmental and social practices in coffee production, we have selected two coffee cooperatives located in the Tarrazú canton, San Jose province, Costa Rica (see figure below).

Study area. Top right depicts San Jose province in Costa Rica (marked red). Center depicts the location of the Tarrazú canton within the province of San Jose. Both cases are located in Tarrazú.

The physical proximity of the cooperatives has the main advantage that some conditions influencing environmental and social practices as defined above are comparable. For example are agroecological and infrastructural conditions similar; in both cooperatives coffee is grown at high elevations on slopes of volcanic soil and the distance to markets is comparable. Furthermore, some economic and political conditions are expected to have influenced both communities in the same manner, i.e. policy at the canton level and market prices.
However, both cooperatives have some distinct characteristics which we expect to influence the environmental and social outcomes in different manners. Some of the main intrinsic characteristics of each cooperative are depicted in the table below (source: Snider 2013).

	Coope LlanoBonito	**Coope Tarrazú**
Size (no. of members, total area)	640 members, 1200 ha	2900 members, 6000 ha
Founding year	1972	1960
Elevation	1100-2000 m	1100 – 1500 m
Coffee Quality	100 % SHB	100 % SHB
Quantity	19.300 quintales	230.000 Q
Certificates (entry year/no. of members certified)	Fairtrade (1999/collective certification), CAFÉ (2006/collective certification), formerly: Rainforest Alliance (only in 2008/ no. of cert. producers unknown)	Fairtrade (2004/collective c.), CAFÉ (2004/collective c.), Rainforest A. (2003/120 members certified)
ha for each certificate	1200 ha Fairtrade, 1200 ha CAFÉ	6000 ha Fairtrade, 6000 ha CAFÉ, 1040 ha RA
Member of consortium	COOCAFE	-
% of total harvest 2012 sold under each label	60% FT, 4% CAFE	36% FT, 22% CAFÉ, 11% RA
Increased costs/work due to certification ?	No extra costs/one engineer dedicates 25-30% of his time to certification issues	Yes, extra costs for internal control system implementation / One employee dedicates 30% of his time to certification issues
Machinery obtained due to certification	Yes, pre-drying machinery + cars	-

	Coope LlanoBonito	Coope Tarrazú
Other types of infrastructure modified due to certification	-	Yes, the *beneficio*
Comments	Small cooperative with high average age of members (65 years), economic situation of the coop is a major concern (according to administration)	Multi-service cooperative, incl. technical assistance, supermarkets, repair service, hardware store, providing low prices on fertilizers, low-interest loans etc.
Info on environmental practices / training etc.	Soil erosion and fertility problems 80s: no environmental protection measures 85-90: some shade production + soil covering began Now: efforts to increase the amount of shade grown coffee (CATIE AF project in 2000) and minimize soil erosion with vegetative cover. Receive trainings from NA, CATIE, MAG. Internal farmers' training by 1 agronomist (emphasize on pest& disease management); resources are limited Hardest rules to comply with: pesticide use, agrochemicals, PPE	Strong commitment to protect the environment (according to administration). Moto "solidarity and sustainability". Sustainability projects: water conservation and coffee pulp recycling (composting). Farmer training in management of shade, management of pests and disease, diversification of other products, protection of water, wildlife etc.. 2 promoters provide farmer trainings,; in conjunction with CATIE and Gabi Soto; special programmes offered to women, immigrant groups. Several research and development projects ongoing: carbonization of brushwood and making of briquettes, wood energy, solar brushwood drying, production of juice concentrate, and reaction of biodigestion leachate, installation of solar panels etc. Starbucks and Earthwatch have been involved in environmental projects at Tarrazú (research and trainings)

Study Design

The research design will be an *embedded comparative case study*, comparing CoopeLlano Bonito with Coope Tarrazú with emphasize on differences between and similarities of the two cases. Within each cooperative there will be two levels of analysis consistent with the two levels of analysis ("cooperative level" and "farm level") mentioned in the definitions section above. The **first unit of analysis** will be each cooperative represented by its cooperative **administrators**; in this will be embedded a **second unit of analysis**, consisting of individual coffee growing **members** of the cooperatives. This design will provide a holistic view on the issue at hand since possible discrepancies between farmers' and administrators' perceptions within each cooperative will be taken into consideration.

Methodology

Because the study will be case based and, besides investigating practices, also aims at exploring farmers' and administrators' perceptions, mostly qualitative methods will be applied. The methodology matrix below depicts methods employed to answer each of the Research (Sub-) Questions.

PRELIMINARY

Methodology Matrix *

	1A **Changes** in environmental and social practices ***at farm level*** in the past 20 years 1B **Changes** in environmental and social practices ***at cooperative level*** in the past 20 years 1C **When** did these changes occur?		1D **Changes** in **external factors** in the past 20 years 1E **When** did these changes occur? 1F **Relationship** between changes in environmetal and social practices and changes in external factors	2A-E **Perceived Drivers of Changes** in environmental and social practices at farm and cooperative level	
	1st Unit of Analysis: Administrators	*2nd Unit of Analysis: Farmers*		*1st Unit of Analysis: Administrators*	*2nd Unit of Analysis: Farmers*
Semi-Structured Interviews with Coop Administrators and Agricultural Extensionists (n=2 per coop)	X		X	X	
Review of Internal Documents	X		X		
Focus Group Discussions with farmers (n=5 per coop)		X	X		X
PRA: Timeline (n=1 per coop)		X	X		X
Semi-Structured Interviews with Farmers (n=25 per coop)		X	X		X
Review of Literature, Secondary data sources			X		

* See next page for further information on each method employed.

PRELIMINARY

First of all we will conduct **Semi-structured Interviews with Cooperative Administrators and Agricultural Engineers** (min. n=2 per cooperative) since we expect them to be able to provide a good overview of environmental and social practices of the cooperative as a whole. For this it is very important that we obtain information for past events (changes in practices during the last 20 years). Therefore, if possible, former cooperative managers will also be interviewed. Information obtained from semi-structured interviews with administrators is expected to serve as a good starting point for further analysis. It is furthermore believed that the cooperative management should first be informed about research objectives and procedures before going into depth with interviewing farmers. If appropriate, and only after creating rapport, cooperative administrators will be asked to provide insight into **internal documents**. It is hoped that the documents give hints on changes in environmental and social practices with special regards to external factors having influenced practices at certain points in time.

Next we will be conducting **Focus Group Discussions** (n=5) **with Farmers** at each cooperative. The participants, ideally a group of 5-7 coffee growers, will be selected according to their duration of membership in the cooperative (at least 20 years). By including only farmers which have been coffee growing for a long time, we make sure that we also obtain information on environmental and social practices from 20 years ago. The objective of conducting focus group discussions is to document changes in coffee production practices on the community level. Embedded into the Focus Group Discussion will be a **PRA exercise: The creation of a Timeline (n=1)**. We will ask the participants to draw, with our assistance, a timeline which depicts changes in environmental and social practices in the last 20 years, including information on *when* the respective changes occurred (points in time). We will then "overlay" the timeline drawn by the participants with relevant "external" events that have taken place at that particular time (i.e. certification, changes in environmental law, coffee price fluctuations etc.). To investigate "how certification and other factors coincide with changes in envionm. and social practices", we check what changes in practices both cooperatives have in common, and how these common changes coincide with external events.

Both interviews with administrators and focus group discussions will provide a good starting point for successfully conducting **Semi-Structured Interviews with Farmers** (n=25 per cooperative). During these interviews we will then be able to go into detail about changes in practices and, most importantly, perceived reasons for each of the changes (identifying "drivers of change", see Question 2).

All methods applied will be complemented by **Participatory Observation** at all times during fieldwork. The researcher will live in physical proximity to both cooperatives' lands, which allows for various informal field visits and talks with cooperative members. Furthermore, special emphasize will be put on the **Triangulation** of results, i.e. will various sources of information be recruited to answer a certain question and research results will be presented to study participants for validation.

Partners

- Local Partner in Costa Rica: CATIE (Tropical Agricultural Research and Higher Education Center). Official Contact: Isabel A. Guttierez-Montes, Rural Sociologist, Turrialba, Costa Rica (igutie@catie.ac.cr)
- Anna Snider (AgTraIn PhD candidate, Montpellier/Madrid): The master thesis will be embedded into her PhD on Sustainable Coffee Certifications in Costa Rica

PRELIMINARY

- Supervisors at Copenhagen University: Andreas de Neergaard (Prof.), Department of Plant and Environmental Sciences (contact: adn@plen.ku.dk), and Aske Skovmand Bosselmann (PhD), Department of Food and Resource Economics (contact: ab@ifro.*ku*.dk)

Timing

Fieldwork is scheduled for 3 months (15/07/14 until 15/10/14) and interviews will be accompanied by an on-site stay in the study area (physical proximity to both cooperatives at all times). To avoid interpreter bias a 5-week intense Spanish course is planned ahead of the fieldwork. Current level of Spanish: Basic/Intermediate. The course will take place in Guatemala at a language school specialized in teaching of social, political and economic vocabulary.

Preliminary Timeline for Fieldwork:

July		August	September	October
12.- 14. July	16. July - 31. August		1. September - 15. October	
Visit at CATIE (Local Partner) Review of relevant Documents	Fieldwork at Coope LlanoBonito Semi-structured Interviews with Farmers (min. n=12), Cooperative Administrators (min. n=2) and Focus Group Discussion with Farmers incl. PRA Timeline (min. n=1)		Fieldwork at Coope Tarrazu Semi-structured Interviews with Farmers (min. n=12), Cooperative Administrators (min. n=2) and Focus Group Discussion with Farmers incl. PRA Timeline (min. n=1)	

References (for Preliminary Proposal)

Luetchford 2007: Fair Trade and a Global Commodity: Coffee in Costa Rica. by Luetchford, P. Pluto Press, London (UK). 226 pages. 2007.

Ronchi, L. (2002). The impact of Fair Trade on producers and their organizations: A case study with Coocafé in Costa Rica. *Policy Research Unit: University of Sussex, Sussex*.

Raynolds, L. T., Murray, D., & Heller, A. (2007). Regulating sustainability in the coffee sector: A comparative analysis of third-party environmental and social certification initiatives. *Agriculture and Human Values*, *24*(2), 147-163.

Miranda, M., Porras, I. T., & Moreno, M. L. (2003). *The social impacts of payments for environmental services in Costa Rica: a quantitative field survey and analysis of the Virilla watershed* (No. 1). IIED.

Snider, Anna 2013 [unpublished], Field Report Costa Rica 2013. Ungoing PhD project [AgTrain Erasmus Joint Doctorate Program, Montpellier SupAgro/Universidad Politecnica de Madrid].

Elder, S.D., H. Zerriffi, and P. Le Billon (2012). Effects of Fair Trade certification on social capital: The case of Rwandan coffee producers, World Development, 40 (11) 2355-2367.

Elder, S.D., H. Zerriffi, and P. Le Billon (2013)"Is Fairtrade certification greening agricultural practices? An analysis of Fairtrade environmental standards in Rwanda." Journal of Rural Studies. Vol. 32, (October 2013)